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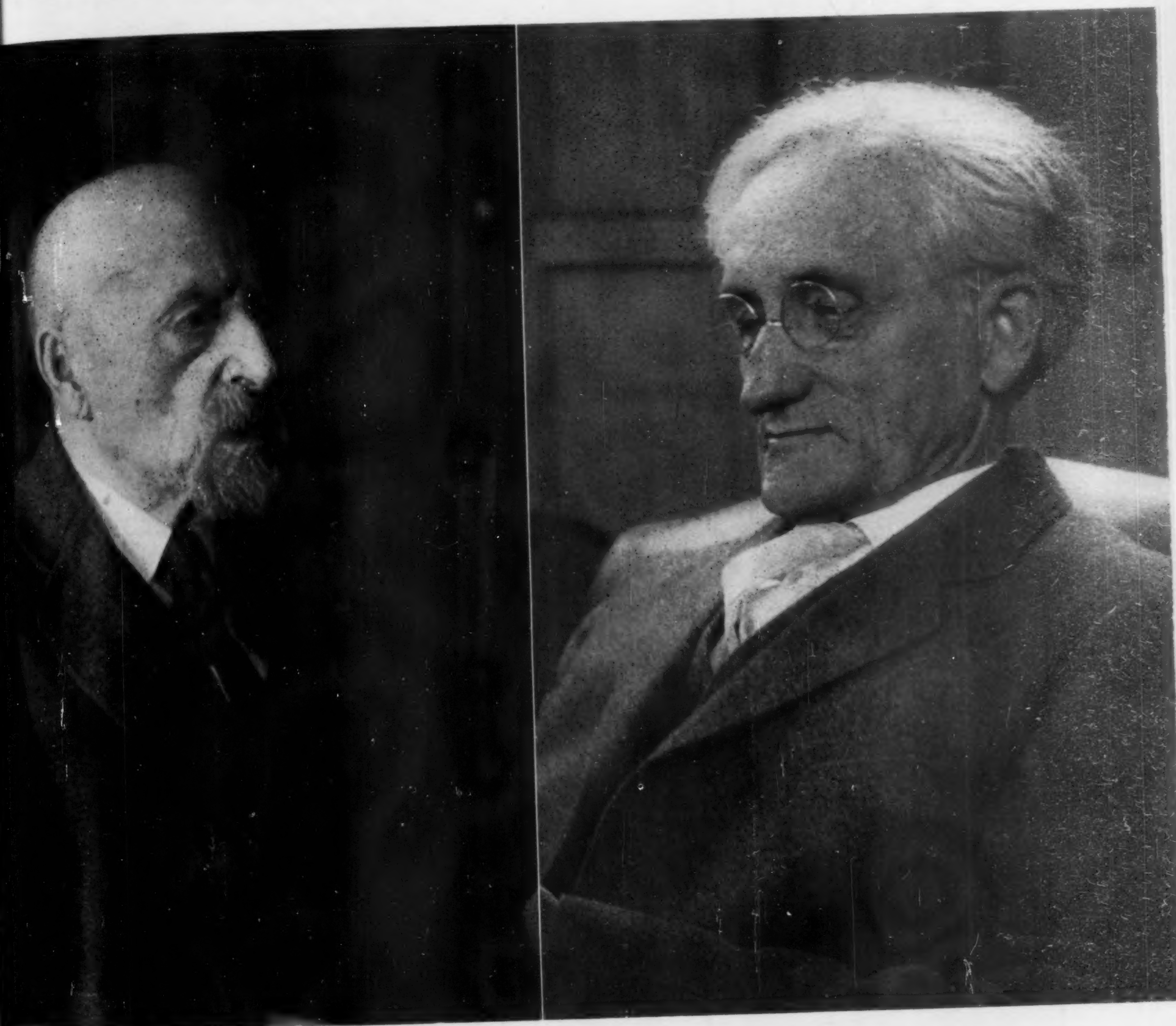

Past Presidents L. O. Howard (1920) and L. H. Bailey (1926)

(See *page 218*)

1848 – American Associaton for the Advancement of Science—1948

Science

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CONTENTS

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The American Association for the Advancement of Science: *A Brief Historical Sketch*

F. R. Moulton, ***Administrative Secretary***

SOON AFTER THE FIRST PERMANENT settlements in this western world, our hardy predecessors began to establish churches, schools, and scientific societies. Harvard College was founded in 1636, and in 1743 Benjamin Franklin organized an informal scientific society which later became the American Philosophical Society.

After the colonists attained their political independence and a stable government, they directed their attention to improving education and advancing science. In the constitution of the Commonwealth of Massachusetts, adopted in 1780, we find: ". . . it shall be the duty of Legislatures and Magistrates, in all future periods of this Commonwealth, to cherish the interests of literature and the sciences, and all seminaries of them . . . to encourage private societies and public institutions, rewards and immunities, for the promotion of agriculture, arts, sciences, commerce, trades, manufactures, and a natural history of the country. . . ." With the riches and mysteries of an unknown continent stretching before them, they naturally were most interested in geology and natural history. Between 1823 and 1839 the legislatures of 17 states made provisions for geological surveys. These interests led to the founding of geological societies, all of which soon ceased to exist.

Even more ambitious plans for national scientific societies were launched in the same period and resulted in greater failures. In 1816 the Columbian Institute for the Promotion of Arts and Sciences was founded, among whose officers and members there were John Quincy Adams, Daniel Webster, Henry Clay, and other prominent men of the day. With the passing of its original moving spirits, it became moribund by 1825 and was succeeded by the National Institution for the Promotion of Science. This new society held one meeting (in 1844) which was attended by officials of the highest rank in governmental circles. Its founding was a valiant attempt to organize science under central political sponsorship, but it also failed without an appreciable effect upon American science and culture.

In 1831 the British Association for the Advancement of Science was established by British scientists. A distinguished citizen of Boston, Dr. John Collins Warren, attended a meeting of the British Association in 1837 and presented a paper. He was so greatly impressed by the meeting that upon his return to the United States he promptly undertook to promote the organization of a similar society in this country. Finally, the Association of American Geologists, at its last meeting on September 24, 1847, passed a resolution to transform itself into the "American Association for the Promotion (later, Advancement) of Science," an organization "designed to embrace all laborers in Physical Science and Natural History."

The following year, at 12 o'clock on September 20, 1848, under the chairmanship of Prof. William B. Rogers, the Constitution and Rules of Order of the new society were read and adopted, and thus the American Association for the Advancement of Science was established. Its initial membership was 461.

The second meeting of the Association was held in Cambridge, Massachusetts, in 1849 under the presidency of Joseph Henry and with a greatly expanded program. In 1850 the Association held two meetings, one in Charleston, South Carolina, in March, and one in New Haven, Connecticut, in August. The proceedings of the meetings filled a volume of 629 pages. The membership of the Association had increased to 684, and the new society, national in scope and comprising all sciences, was well on its way to success.

In the decade from 1851 to 1860, inclusive, the Association held 10 meetings, one of which was in Montreal, the first AAAS meeting held in Canada. Louis Agassiz, the famous Swiss zoologist, was president of the Association in 1851. The fields of specialization of the other presidents of the decade were physics, anthropology, botany, geology, chemistry, medicine, and astronomy. The horizons of specialists in every field were broadened by the variety of the subjects discussed by the foremost American scientists of the day. In this and the immediately preceding periods, such far-reaching and various scientific advances had been made as the synthesis of an organic compound by Wöhler, the geological uniformities noted by Lyell, the conservation of energy by Mayer and Joule, its extension to the organic world by Helmholtz, the cell theory by Schleiden and Schwann, the relations between electricity and magnetism by Faraday and Joseph Henry, and the first revolutionary excursions by Darwin, Wallace, and Spencer into the fields of organic evolution. As to technological ap-

plications of science, it was in this period that Morse invented the telegraph, Daguerre succeeded in photography, and Long and others introduced ether, chloroform, and other compounds to produce anesthesia.

Clearly, in these years the soundness of the plan of organization of the AAAS was established, the value of its meeting was beyond question, its support by scientists of the highest standing was enthusiastic and unfailing. A new era in cooperative organized American science was well under way.

The first timidly hopeful years of the Association were succeeded by others of increasing confidence in its mission and its success. There were, however, trying periods. In the second decade in the life of the Association the Civil War between the North and the South broke out. Those who had cooperated in winning their independence and establishing an orderly government, and in organizing science on a national scale, suddenly became enemies.

For 5 years the Association held no meetings, it published no journals or reports, its organization was shattered. Yet the memory of 12 successful earlier years (1848–60) remained, and in 1866 a meeting was held in Buffalo, New York. It was not such a meeting as had been held in earlier years; nor was the meeting in Burlington, Vermont, in the following year. Only 75 papers were presented at the Burlington meeting, and the membership of the Association had declined from 641 to 415.

The vitality of the Association did not fully return until about a decade after the close of the Civil War. By 1875 the membership of the Association had increased to 807; by 1880 it was 1,555; in 1890 it was 1,944 and remained at about that level until 1900. The number of papers presented at meetings in these 20 years ranged from about 200 to 400.

Beginning with 1900, the membership and influence of the Association rapidly increased, and at the outbreak of World War I the membership was 8,325. In this period the meetings were correspondingly larger and better than in earlier years. During the war the Association continued to function on a somewhat limited scale, but immediately after its close the membership and influence of the AAAS again increased rapidly, for science had been a very important factor in winning the war. In the decade 1920-30 the paid-up membership of the Association increased from about 10,000 to about 18,000. Then, for nearly a decade it changed very little, after which it increased steadily during World War II and more rapidly after its close. The present membership exceeds 40,000.

With the rapid growth of science in recent decades many societies in special fields became so large that it was necessary for them to hold meetings of their own. Most of them grew out of sections of the Association and are affiliated with the Association, having representatives on its Council, its supreme governing body. The total membership of the affiliated societies is several hundred thousand. With the necessity for separate meetings, some of the advantages of joint meetings of scientists in related fields are lost. Scientific statesmanship is now required in establishing relations among scientific societies in order that science may measure up to its possibilities of service to society.

In partial preparation for this high purpose, the Association in 1946 purchased, with funds it had saved from operations and gifts from its members, a very desirable and adequate site for a permanent Science Home in Washington. It now begins the second century of its existence with pride in its past and a deep sense of responsibility for its future and the future of science and civilization.

Pictured on the cover of this week's issue of *Science* are two men who have for many years been interested in the activities of the AAAS—L. O. Howard (*left*), former chief entomologist of the U. S. Department of Agriculture, who was permanent secretary of the Association from 1898 to 1919 and its president in 1920; and Liberty Hyde Bailey (*right*), emeritus professor of agriculture at Cornell University and director of the Bailey Hortorium, who was the 1926 president of the Association. For these men, the oldest living past presidents of the AAAS, "A Century of American Science" will have great meaning. Dr. Howard celebrated his 91st birthday on June 11 of this year; Dr. Bailey, his 90th, on March 15.

Greetings From the British Association

To all the members of the American Association for the Advancement of Science from all the members of the British Association for the Advancement of Science, fraternal greetings and warmest congratulations on the attainment of the hundredth anniversary of your Association.

We are proud of the fact that the British Association, founded in 1831, served, to some extent, as a model for the American Association and that it has been possible for our two Associations to work in close harmony during the past century.

As you halt at this turning point to assess the achievements of a long journey and to survey the prospects on a road that knows no ending, we assure you of our continued interest and cooperation in all that you undertake for the achievement of our common aims and high purposes.

We have seen your Association grow steadily into an organisation of over 40,000 members, with an affiliated membership of more than half a million men and women, and your annual meetings become the largest general assemblies of scientists in the world.

We have also watched with admiration and respect your growth not only in numbers but in strength and in influence which, without serious interruption by the Civil War and two world wars, has made such substantial contributions to the advancement of science and its applications to human progress.

With congratulations on the solid achievements of the past hundred years, we send cordial good wishes for the success of all the responsible work that lies in the future and trust that your second century may begin with a brilliantly successful week of celebration and discussion.

During the past half century there have come about changes in the conditions of life more far reaching than any others in human history. Distance has been virtually annihilated and all men have become neighbours. But men are not yet neighbours in spirit as well as truth, and the universal status of science, which is its proudest claim, is also its greatest opportunity. In an age which is characterised by perfection of means and confusion of ideals, science and the discipline of science, which admit no frontiers of race or creed, provide a basis for effective international cooperation in promoting the welfare of mankind.

May it not be too much to expect that there may go forth from so great a gathering of men of science in Washington a new message of hope to a troubled world.

(Signed) Sir Henry Tizard, *President*
Dr. E. F. Hindle and
Sir Richard Southwell, *General Secretaries*

Burlington House
London, England
June, 1948

The AAAS on the Pacific Slope

Robert C. Miller
Secretary of the Pacific Division

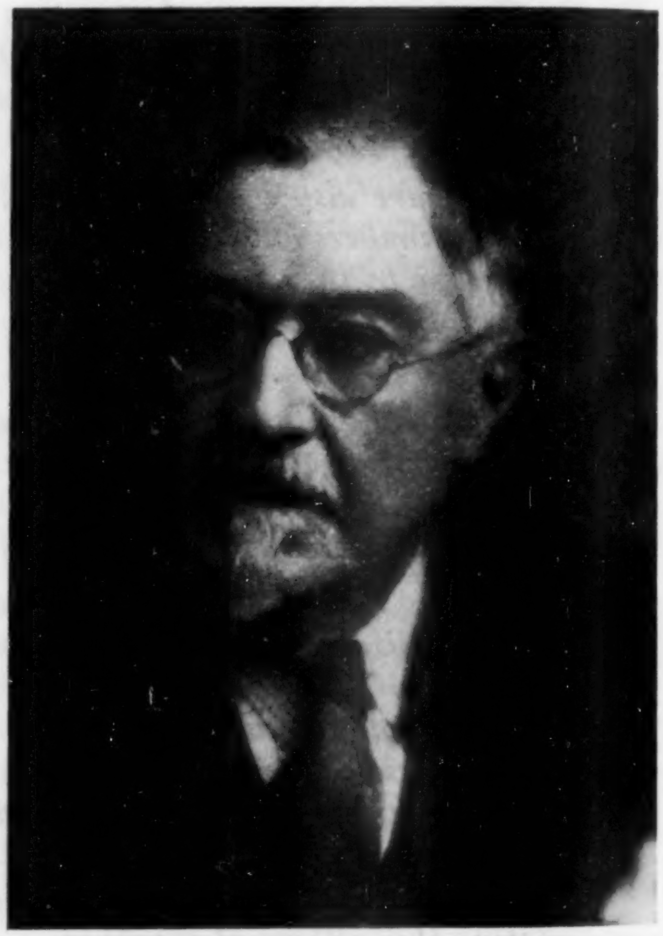
IT IS NOW A COMMONPLACE EXPERIENCE to have dinner in Seattle, Portland, San Francisco, or Los Angeles and lunch the following day in Washington, Philadelphia, or New York; or, pursuing the sun in its westward course, one may easily travel from the Atlantic to the Pacific seaboard between dawn and dusk. But in the earlier years of the present century the continent still seemed very wide; and most people contemplated its crossing, if not with trepidation, at least with a sense of its being a major undertaking. To residents of the Pacific Coast, New York seemed almost as remote as London or Paris; on the other hand, persons living along the Atlantic seaboard found it actually easier to get to Europe than to California.

Under these circumstances it was inevitable that regional organizations of scientific workers should be formed in the rapidly growing West, and the American Association for the Advancement of Science was well advised to authorize the formation of western regional divisions.

Curiously enough, the initial steps leading to the formation of a Pacific Division were taken at Cleveland, Ohio, in the absence of most of the persons most vitally concerned and, indeed, in a certain sense because of their absence. At the Cleveland meeting of the Association, December 30, 1912–January 4, 1913, D. T. MacDougal, then a member of the highly important Committee on Policies of the AAAS, pointed out to his fellow committee members that, of the several hundred members of the Association residing on the Pacific Coast, only two were in attendance at the annual meeting. It was obvious that the distance was too great and the time and personal expense involved were too much to permit any large attendance of members from the Far West at eastern meetings.

Dr. MacDougal was himself particularly in a position to appreciate and to convince his colleagues of the difficulty. As director of the Laboratory of Plant Physiology of the Carnegie Institution of Washington, he had his headquarters in Washington, D. C., and his laboratory in Tucson, Arizona. The journey by rail took 5 days each way and if, as sometimes occurred, he had to make the round trip three times in a year, he found himself spending one month out of 12 on the train.

Of considerable importance in its bearing on subsequent events was the circumstance that the Association had already decided, at its 1911 meeting, to hold a special meeting on the Pacific Coast in 1915, in honor of the international expositions that were being planned at San Francisco and San Diego to celebrate the opening of the Panama Canal. A committee to make arrangements for this meeting was accordingly appointed at the Cleveland meeting referred to above. This committee, as first appointed, included the following: W. W. Campbell (chairman), John C. Branner, Wm. Alanson Bryan, H. S. Carhart, Charles Lincoln



D. T. MacDougal

Edwards, William T. Foster, George Ellery Hale, M. W. Haskell, E. W. Hilgard, George H. Howison, O. P. Jenkins, David Starr Jordan, Thomas F. Kane, Vernon Kellogg, C. A. Kofoid, A. L. Kroeber, Andrew C. Lawson, E. P. Lewis, J. H. McBride, D. T. MacDougal, Lillien J. Martin, John C. Merriam, Agnes Claypool Moody, John Muir (died in 1914), W. E. Ritter, H. J. Ryan, Fernando Sanford, W. A. Setchell, John M. Stillman, and Benjamin Ide Wheeler. Subsequently it was enlarged through the addition of

Maxwell Adams, Melvin A. Brannon, Enoch A. Bryan, Henry Landes, A. O. Leuschner, Joseph F. Merrill, and Lyman B. Stookey.

All of the members of the committee were residents of the West or of Hawaii. They were authorized "to hold in the name of the Association meetings of its members resident in that region, for the purpose of considering the relations of the Association to the exposition in question, and if desirable, for the presentation of scientific programs. The expenses incurred shall be met from funds in the hands of the permanent secretary. . . ." It appears further to have been understood, as a result of Dr. MacDougal's representations to the Committee on Policies, that the western regional committee would also explore the possibility of setting up a Western Division of the Association, although this was not recorded as a part of the formal instructions of the committee, possibly because there was at that time no provision in the Association's constitution for the formation of regional groups. At all events, the new committee, whether with or without authorization, began immediately to study this problem and, though officially designated the Committee on the San Francisco Meeting, it became also in effect a committee for the organization of a Pacific Division.

The committee held its first meeting at the University of California (Berkeley) on April 12, 1913, with about 20 members present, Dr. Campbell in the chair and E. P. Lewis serving as secretary. Plans for the 1915 meeting in San Francisco were discussed and subcommittees were appointed. Then, according to the report of the secretary, "the question of the organization of the Pacific Coast members into a geographical division with power to hold meetings and present scientific programs was discussed at length."

David Starr Jordan, a man of tremendous influence at this period, did not accept the idea readily, fearing that the national association would disappear in a group of ever-increasing divisions. Dr. Campbell, on the other hand, was convinced of the wisdom of Dr. MacDougal's view, and their joint counsel prevailed, with the result that "a motion that it be the sense of the committee that such a division should be established was unanimously carried; but it was the general feeling that the success of such a step would depend upon the attitude of the Pacific Association of Scientific Societies."

"It is to be hoped," Dr. Lewis' report continues, "that this association will merge itself into the Pacific Coast Division of the American Association and its constituent societies become affiliated with the latter. The executive committee [consisting apparently of Dr. Campbell alone] was asked to consider the whole matter and to endeavor to secure the cooperation of the various scientific societies on the Pacific Slope."

Ten days later, on April 22, 1913, Dr. Campbell attended the meeting of the Council of the Association held in Washington, D. C., where he presented the views of his committee, with the result that the committee was authorized to secure an associate secretary for the Pacific Coast and "in the absence of constitutional authority, to designate its meetings at which scientific programs are presented as 'Meetings of the Pacific Coast Division of the American Association for the Advancement of Science,'" (*Science,* May 2, 1913, p. 662). At this meeting of the Council, powers were also delegated to the Committee on Policies of the AAAS "with respect to all arrangements concerning the organization of the Pacific Coast Division of the Association, including all matters relating to the affiliation of the individual societies composing the present Pacific Association of Scientific Societies."

In the minutes of this meeting the western committee, originally designated as the Committee on the San Francisco Meeting, is referred to simply as the "Pacific Coast committee." However, it was authorized to and did carry out all arrangements for the very successful San Francisco meeting of the Association, August 2–7, 1915, which was a national, not a divisional meeting.

The Pacific Association of Scientific Societies, which figured prominently in discussions of a regional

division of the AAAS, had been formed in 1910 to promote cooperation among western scientific organizations. After successful annual meetings in 1911, 1912, and 1913, it had come to embrace 14 societies and represented a constituent membership of 2,167. Clearly, the attitude of this organization could be a determining factor in the success or failure of the new proposal. As Dr. Campbell stated subsequently (*Science,* April 30, 1915, p. 638):

> The men and the societies that were making a success of the Pacific Association were identically the men and the societies that would be expected to make a success of the Pacific Division of the American Association. Evidently there must be no duplication. The only practicable solution required that the Pacific Association should give up its identity and that the forces which were active in the Pacific Association should be active in the work of the Pacific Division. It was evident that the Pacific Division offered important advantages over the existing organization, in part from the resulting unification of general scientific interests throughout America. The problem was approached in a sympathetic and unselfish spirit by all concerned, especially by the officers and more active members of the Pacific Association. . . .

The second meeting of the Pacific Coast committee was held in San Francisco on February 7, 1914, with Dr. Campbell in the chair and E. P. Lewis again serving as secretary. At this meeting Albert L. Barrows was elected associate secretary for the Pacific Coast, the position which the Council of the Association had authorized the previous year. George D. Louderback was present as a representative of the Pacific Association of Scientific Societies. A general plan of organization was adopted, the word "Coast" was dropped and the name shortened to "Pacific Division," and a subcommittee was authorized to draft a constitution.

The constitution was ready in time to be approved at the fourth and last annual meeting of the Pacific Association of Scientific Societies, held in Seattle on May 21–23, 1914, and was referred to the constituent societies of that association for their action. Since there would be no separate meeting of the Division in 1915, the change "whereby the Pacific Association was to become the Pacific Division of the American Association" was planned to take place at the end of the 1915 meeting of the Association in San Francisco, "provided that by that time two-thirds of the constituent societies have approved and signed the constitution and also provided that the Pacific Division is ready with its officers to take up the work of the Pacific Association."

By the following spring the required two-thirds vote had been secured, with two societies dissenting and two not having taken action. J. N. Bowman, secretary of the Pacific Association, published the results of the balloting (*Science,* April 9, 1915, p. 526) and announced that the archives of the Pacific Association would be turned over to the new Pacific Division in August.

The societies making up the Pacific Association at the time of its voluntary dissolution were as follows:

Astronomical Society of the Pacific
Biological Society of the Pacific Coast
California Academy of Sciences
Cooper Ornithological Club
Cordilleran Section of the Geological Society of America
Geographical Society of the Pacific
Pacific Coast Paleontological Society
Pacific Coast Branch of the American Historical Association
Pacific Slope Association of Economic Entomologists
Philological Society of the Pacific Coast
Puget Sound Section of the American Chemical Society
San Francisco Section of the American Chemical Society
San Francisco Section of the American Mathematical Society
San Francisco Section of the Archaeological Institute of America
Seismological Society of America
Technical Society of the Pacific Coast

The position of the newly formed Pacific Division as successor in interest to the Pacific Association of Scientific Societies gained for it the immediate support of the most active scientific workers and organizations in the West and also, to a degree, influenced its character. The Division, for example, has never formed sections along the lines of the national organization, but has depended on its affiliated and associated societies, now 42 in number, to provide suitable technical programs in their respective fields. The character of the Division as a unified organization is maintained through annual meetings of the Council, interim meetings of the Executive Committee, and certain general sessions held at each annual meeting. One of these is the divisional symposium; another is the convocation for the presidential address. Additional general sessions are held as occasion may require or render desirable.

The first annual meeting of the Pacific Division was held in San Diego on August 9–12, 1916, with W. W. Campbell serving as president, A. L. Barrows as secretary, and D. T. MacDougal as chairman of the Executive Committee. An interesting feature of the meeting was the dedication on August 9 of a new museum and library building and a new concrete pier at the Scripps Institution for Biological Research (now the Scripps Institution of Oceanography) at La Jolla. Seven societies took part in the scientific program of the San Diego meeting, and the total registered attendance was 120.

It is interesting to compare with this the second San Diego meeting, held 31 years later (June 16–21, 1947), at which 19 societies held sessions for the reading of scientific papers, and the total registered attendance was just under 1,000. Apparently the founders of the Division were right in their belief that such a regional organization would serve an important function.

At the meeting of 1920, held in Seattle, action was taken—in accordance with similar action by the national organization—transferring to the jurisdiction of the newly formed Southwestern Division the States of Chihuahua and Sonora in Mexico, and the State of Arizona, which had figured prominently in the formation of the Pacific Division. Dr. MacDougal, who had served as president of the Pacific Division from 1917 to 1919, was subsequently elected president of the Southwestern Division, a combination of honors few are likely to achieve.

The Pacific Division, as presently constituted, includes all members of the Association residing in Alaska, British Columbia, California, Hawaii, Idaho, Nevada, Oregon, Utah, and Washington. Meetings have been held each year since 1916, with the exception of 1918 and the period 1943–45, the lapse in each case being due to conditions imposed by war.

The 1948 meeting was held at the University of California, Berkeley, on June 21–26, under the presidency of Roy E. Clausen, with Howard S. Reed serving as chairman of the Executive Committee. Twenty societies participated in a program of some 350 scientific papers. The secretary was pleased to be able to state that membership in the Division had risen to the unprecedented figure of 3,644.

Dr. Clausen announced the election, as president for the ensuing year, of L. S. Cressman, professor and head of the Department of Anthropology at the University of Oregon and also that the Division had accepted the invitation of the University of British Columbia to hold its next meeting on the campus of that institution. The 30th annual meeting of the Pacific Division will accordingly be held in Vancouver, B. C., June 13–18, 1949. The Division looks forward with pleasure to its first Canadian meeting.

L. S. Cressman

The Southwestern Division of the AAAS

Frank E. E. Germann
Permanent Executive Secretary-Treasurer

SCIENTIFIC ACTIVITY IN THE UNITED STATES prior to 1920 reached an all-time high during World War I. Prior to that time, one could count the American industrial laboratories doing truly fundamental research on the fingers of one hand. Basic research carried on in our universities was in a much more healthy state, but even here, work leading to the Ph.D. was restricted to a very few of our large and more prosperous private and state institutions. In order to get the best in education before 1914 it was deemed almost essential to do either doctorate or, at least, postdoctorate work in the better European universities. As evidence of this fact one need only survey the academic training record of the distinguished American professors of that period. During the war, research programs were initiated in a large number of industrial laboratories, where, prior to that time, the only scientific work that had been attempted was that in the nature of routine control tests. This increase in activity was almost exclusively in the field of chemistry, although in a few isolated cases physical and biological research studies were started. This development on the part of industry was due to the cutting-off of the supply of chemicals and physical apparatus formerly obtained largely from Germany. As a case in point, one need only be reminded of the fact that there was great rejoicing in this country when a German submarine "ran" the blockade and delivered a cargo of dyes on the eastern coast some months prior to our entering the war against Germany.

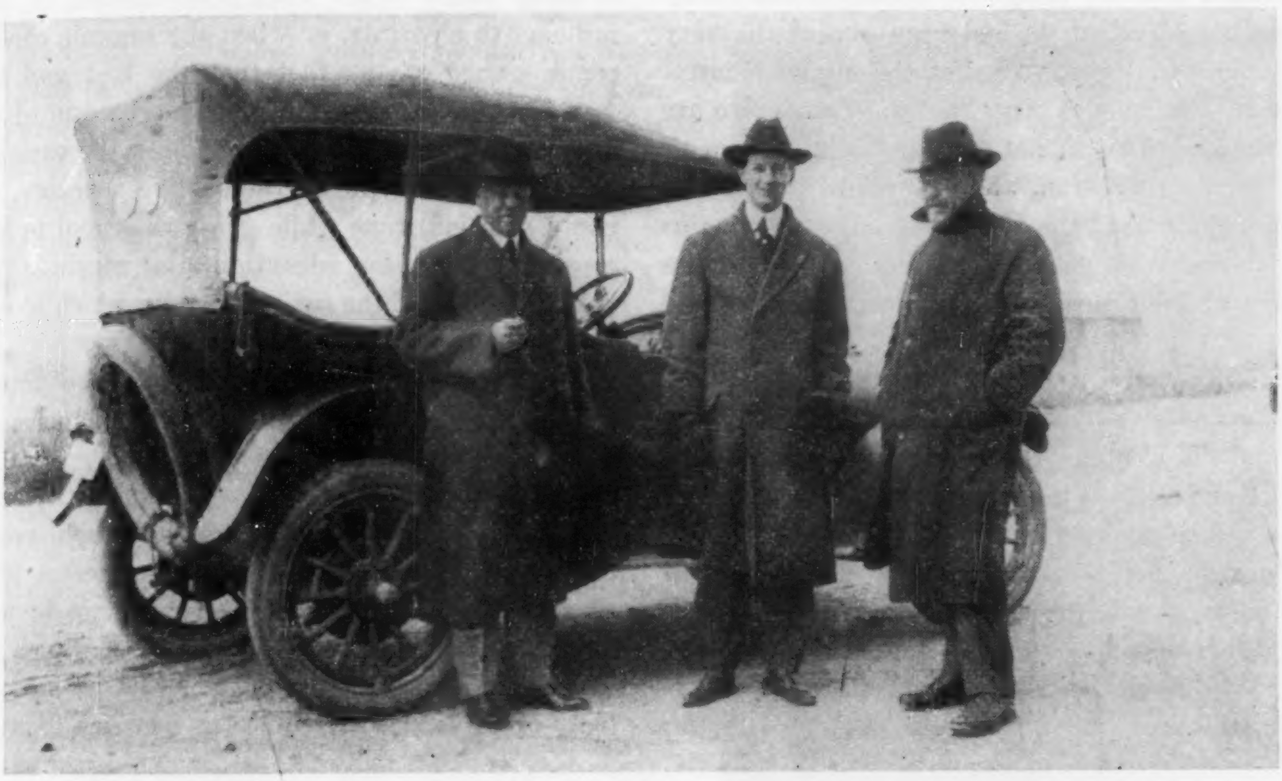
Closely paralleling the increased interest in research in the industries, more and more universities began seriously the development of their graduate schools and the accompanying research programs. Since our students could no longer go abroad, more and more of them started their advanced studies at home in order to qualify for the greatly increased number of positions which had become available. When the war was over, industrial employment of the research worker came to a rather abrupt end, especially with those warborn concerns which could reap handsome profits as long as war-inflated prices were being paid for their product, but which had not had sufficient experience to make a go of it in a highly competitive market. The picture on the academic side was fortunately quite different, and research and graduate study steadily increased. Colleges whose professors had formerly had little interest in doing any more than impart the knowledge they possessed to others now were being manned with young men eager to advance the field of their specialty. These same men also craved the companionship of fellow workers in order to talk over their mutual problems. In the more densely populated East and Middle West such contacts were easily made, either through direct visits or on the occasion of scientific meetings. The situation was not so simple in the sparsely populated states, which also had their institutions of higher learning, and where the desire for progress had been born.

It was in March 1920 that Andrew Elicott Douglass, director of the Steward Observatory and professor of astronomy at the University of Arizona, and Daniel Trembley MacDougal, director of the Desert Laboratory at Tucson, Arizona, started out on a tour of the Southwest in an antique automobile in an attempt to organize the scientists of the region. In the accompanying photograph, taken on March 11, 1920, on the campus of the New Mexico State College of Agriculture and Mechanic Arts in Mesilla Park, New Mexico, Dr. Douglass is shown on the left and Dr. MacDougal on the right, with Dean Barnes, of the College, in the center. As a result of this tour there came into being the Southwestern Division of the American Association for the Advancement of Science.

The first meeting was held in El Paso, Texas, from December 2 to 4, 1920. The affiliated societies participating in this meeting were the American Association of Engineers (Southwestern District), Medical and Surgical Association of the Southwest, New Mexico Archaeological Society, Santa Fe Society of the American Archaeological Institute, New Mexico Medical Society, and El Paso County Medical Society. The president for the first year was Edgar L. Hewett, director of the School of American Research at Santa Fe, while E. C. Prentiss and A. E. Douglass served as vice-president anl secretary-treasurer, respectively. Sections for the first meeting were Human Science, Biological Science, and Physical Science. Twenty-seven scientific papers were presented, in addition to about a dozen special addresses and general talks. Of special interest was a symposium on the subject, "What Are the Problems on Which the Southwestern Division Should Concentrate?," which was presided over by Dr. Hewett.

The Southwestern Division actually came into being

as the result of the approval of the Executive Committee of the Association on April 26, 1920, following a meeting of delegates held in Tucson, Arizona, on April 10, 1920. As originally constituted, the Division included members of the Association resident in Arizona, New Mexico, Texas (west of the Pecos River), as well as the states of Sonora and Chihuahua in Old Mexico. By action of the national Executive Committee on December 26, 1922, members in Colorado were included in the Division, and by a similar action on June 21, 1937, the Texas boundary was extended eastward from the Pecos River in order to include all members in Texas residing west of the 100th meridian.



In 1929 the Southwestern Division inaugurated the John Wesley Powell Memorial Lectures in honor of the distinguished geologist and leader of the first expedition that descended the Colorado River through the Grand Canyon. Each year a distinguished scientist, usually from beyond the bounds of the Division, is selected to deliver an address on a subject of his own choosing. The event has become traditional, and the address is usually the most important one delivered at the annual meeting. Although no definite regulations exist, the attempt has been made to choose the speakers in such a way as to represent as wide a diversity of scientific endeavor as possible. The Powell Lectures who have honored the Division in the past, together with their principal fields of interest, are: William Morris Davis, geology; Rodney H. True, botany; Max Pinner, medicine; Aldo Leopold, forestry; Otto Struve, astronomy; Edgar L. Hewett, archaeology; John C. Merriam, paleontology; A. E. Douglass, astronomy and tree rings; E. R. Hedrick, mathematics; A. H. Compton, physics; D. T. MacDougal, botany; Bernadotte E. Schmitt, modern history; Howard W. Blakeslee, general science; John H. Manley, nuclear physics; and Edwin F. Carpenter, astronomy.

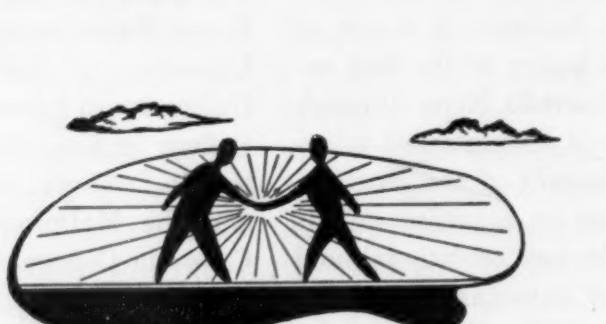
The annual meetings have been held at the principal cities and educational institutions in the region. Following the first meeting in El Paso, host cities and institutions have been: the University of Arizona at Tucson; the Laboratory of Anthropology and the School of American Research at Santa Fe, New Mexico; the University of Colorado at Boulder; Phoenix, Arizona; the Northern Arizona Teachers College, the Lowell Observatory, and the Southwestern Forest Experiment Station in Flagstaff, Arizona; the University of New Mexico in Albuquerque; Denver University in Denver, Colorado; the New Mexico State College in Las Cruces; the Texas Technological College in Lubbock; the Sul Ross State Teachers College and the McDonald Observatory at Alpine, Texas; Colorado College at Colorado Springs; and the New Mexico Highlands University at Las Vegas.

It has been the policy from the beginning to encourage advanced undergraduate and graduate students to attend and actively participate in these meetings, as it serves both as an incentive to them to do something themselves and as a training school in the preparation and presentation of papers of their own. Once these embryo scientists have gained self-confidence in the smaller groups in attendance at these sessions, they are anxious to go to the more important national meetings of their chosen field of interest. When they see and hear one of their fellow students

or teachers telling of his investigational efforts of the past year, they get the urge to do something themselves so that they too may appear on the program at some future meeting. This catalytic effect has been very noticeable and is one of the most important reasons for the existence of the Division.

There is another feature of value in general scientific societies, often missed by those who say that they have no need of associating themselves with us since they already belong to the society representing their own field of specialization. This feature involves the often-overlooked value of being able to talk with specialists in fields beyond one's own, in order to gain a deeper insight into the things we ourselves are doing. This mingling of scientists had been one of the very greatest values of the AAAS, but the sectional meetings have now become so large that, in a sense, we are again isolated. This is not true in the meetings of the Southwestern Division, where total attendance still rarely ever has passed the 500 mark. It still remains possible to meet in general sessions cutting across large areas of interest and have the entire group take an active part in the discussions.

Our parent AAAS has recognized the fact that we have lost something by becoming as large a body as we are, and the Centennial meeting in Washington is exploring various ways to create new values out of our very size. The plan to have no sessions devoted to specific narrow fields, but to explore wide areas of common value, should prove a very interesting experiment, and it is hoped that out of this may come a new type of annual meeting, possibly even regional in character, where it will be possible to become better acquainted with the experts in all fields. So many of our very able young scientists are very familiar with the persons doing pioneer work in their given field, but entirely ignorant even of the names of Nobel Prize winners in other subjects. Although it is too much to hope that at some future date we may again develop men who will simultaneously do fundamental research in mathematics, physics, chemistry, astronomy, and biology, it is a recognized fact that the very breadth of understanding gained by a knowledge of a wide diversity of subjects made it easier for our scientific forefathers to do as much as they did. Never has this been more true than today, when the biologist is being asked to do work with natural or artificial radioactive elements, or when the organic chemist becomes aware of the fact that the best and quickest way for him to learn the exact mechanism of a given organic chemical reaction is to follow the various steps by means of isotopic or radioactive elements. There is not sufficient time while going to school to learn all we should know, but education must continue throughout life. One of the easiest ways in which to continue this education is to be thrown together both socially and in a business way with persons of a different educational background. In the final analysis, this is, therefore, one of the greatest values of general science associations such as the AAAS and its several divisions. It is this feature which we should ever be on the alert to advance. Now that America has most surely come of age scientifically, the world will look to us for guidance. It is the AAAS which may be expected to take the lead, as it always has, since it truly is the leader of science in America today.



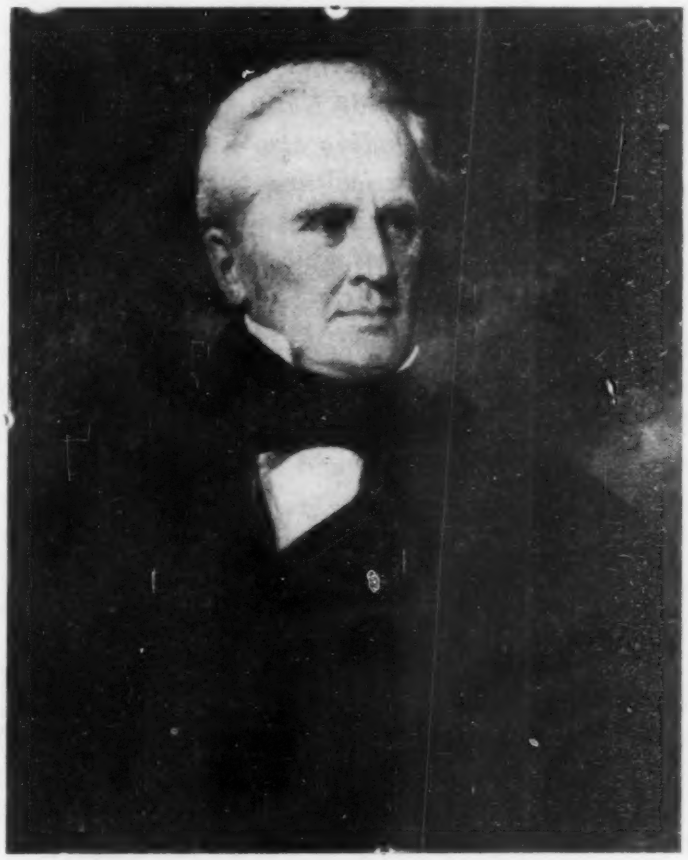
The American Journal of Science, 1818-1948

Edmund W. Sinnott, *President, AAAS*

ONE OF THE CHIEF NECESSITIES for the advancement of science is that enough channels of publication be provided so that the results of research may readily become available to all investigators. In the early days most such channels were furnished by the publications of scientific academies and other societies, embodied in the volumes of their Transactions, Proceedings, and Memoirs and usually published rather irregularly. Such important early means for scientific publication were the *Transactions of the American Philosophical Society,* first published in Philadelphia in 1771; the *Memoirs of the American Academy of Arts and Sciences,* in Boston in 1785; the *Memoirs of the Connecticut Academy of Arts and Sciences,* in New Haven in 1810; the *Journal of the Philadelphia Academy of Science,* in 1817; and the *Annals of the New York Lyceum of Natural History* (later the New York Academy of Sciences), in 1823. Most papers in this country today, however, are published in scientific journals. These may be independent or may be related to some society, but they appear with regularity and are not merely reports of meetings. During the past century there has been a very great increase in the number of such journals and in the specialization of the fields covered by them.

When the American Association for the Advancement of Science was founded, publications of this sort were few. Now and then one was undertaken, but after a brief life, abandoned. One, however, *The American Journal of Science,* was apparently gifted with particular vitality, for, though it was born in 1818, 30 years before our Association, it has survived to our own day, thus maintaining an uninterrupted existence longer than that of any other scientific periodical in the country. Though today it is simply one in a long list of such publications, its influence on the development of American science in earlier days was so profound that it is well worthy of our attention in this Centennial year, when we are turning our eyes back to the history of science in the United States.

This distinguished journal owes its existence to one of the most notable figures in American scientific life, Benjamin Silliman, professor of chemistry, mineralogy, and geology in Yale College during the first half of the 19th Century. Timothy Dwight, farsighted president of Yale at the century's turn, recognized the promise of young Silliman, then only 23 years old and trained as a lawyer, and chose him for this important new chair. Silliman, who at that time had little knowledge of the sciences, set about deliberately and methodically to remedy this defect. He studied intensively in New Haven and in Philadelphia and spent the year 1805 in travel and study in London, Edinburgh, and various centers of learning on the continent. In 1806 he began his active career at



Benjamin Silliman
(Courtesy of Yale University Art Gallery and News Bureau)

Yale. Silliman was a remarkable man, both personally and professionally, as his recent biography by Prof. Fulton well shows. He had a fine presence and was a notable teacher. As a public lecturer, in those days when the lyceum and the lecture platform were so important in American culture, he was remarkably successful in arousing public interest in, and enthusiasm for, the sciences.

Among his many friends was Col. George Gibbs, of Newport, Rhode Island, an amateur mineralogist and collector of some note, who first suggested to him, in 1817, the desirability of founding a scientific journal. Silliman discussed this proposal carefully with many persons and, though somewhat doubtful of its success, was impressed by the great promise of such an under-

taking. "No one," he wrote, "will doubt that a journal devoted to science, and embracing a sphere sufficiently extensive to allure to its support the principal scientific men of our country, is greatly needed; if cordially supported, it will be successful, and if successful, it will be a great public benefit."

Silliman issued "proposals" for such a journal in January 1818, and the first number appeared in July of that year. On the cover of this number is presented the following comprehensive title:

The
American
Journal of Science
More especially of
Mineralogy, Geology
and the
Other Branches of Natural History
including also
Agriculture
and the
Ornamental as well as Useful
Arts

This surely displayed a wide range of interests! The "Plan of the Work," written by the editor as a sort of prospectus for the new journal, emphasizes still more its catholic character and is worth quoting:

PLAN OF THE WORK

This Journal is intended to embrace the circle of THE PHYSICAL SCIENCES, with their application to THE ARTS, and to every useful purpose.

It is designed as a deposit for *original American communications;* but will contain also occasional selections from Foreign Journals, and notices of the progress of science in other countries. Within its plan are embraced:

NATURAL HISTORY, in its three great departments of MINERALOGY, BOTANY, and ZOOLOGY;

CHEMISTRY and NATURAL PHILOSOPHY, in their various branches: and MATHEMATICS, pure and mixed.

It will be a leading object to illustrate AMERICAN NATURAL HISTORY, and especially our MINERALOGY and GEOLOGY.

The APPLICATIONS of these sciences are obviously as numerous as *physical arts,* and *physical wants*; for no one of these arts or wants can be named which is not connected with them.

While SCIENCE will be cherished *for its own sake,* and with a due respect for its own *inherent* dignity; it will also be employed as the *handmaid to the Arts.* Its numerous applications to AGRICULTURE, the earliest and most important of them; to our MANUFACTURES, both mechanical and chemical; and to our DOMESTIC ECONOMY, will be carefully sought out, and faithfully made.

It is also within the design of this journal to receive communications on MUSIC, SCULPTURE, ENGRAVING, PAINTING, and generally on the fine and liberal, as well as useful arts;

On Military and Civil Engineering, and the art of Navigation;

Notices, Reviews, and Analyses of new scientific works, and of new Inventions, and Specifications of Patents;

Biographical and Obituary Notices of scientific men; essays on COMPARATIVE ANATOMY and PHYSIOLOGY, and generally on such other branches of medicine as depend on scientific principles;

Meteorological Registers, and Reports of Agricultural Experiments: and we would leave room also for interesting miscellaneous things, not perhaps exactly included under either of the above heads.

Communications are respectfully solicited from men of science, and *from men versed in the practical arts.*

Learned Societies are invited to make this Journal, occasionally, the vehicle of their communications to the Public.

The editor will not hold himself responsible for the sentiments and opinions advanced by his correspondents; but he will consider it as an allowed liberty to make slight *verbal alterations,* where errors may be presumed to have arisen from inadvertency.

This plan is surely magnificent in its ambition and shows the broad but modest point of view with which the editor approached his task. For many years the contents of the Journal lived up to this prospectus. An article on "Musical Temperament" appears in the first number. We find one on "Mystery" by Mark Hopkins, of Williams, and on "Gypsies" by Prof. Griscom. The Trumbull paintings are discussed, as is architecture in the United States. A paper on Arabic words in English and other linguistic contributions appear. From the beginning, however, the bulk of the papers have been strictly scientific, though it was not until 1880 that "the Arts" ceased to be a part of the title. All fields of science, both practical and applied, were covered. The cotton gin and the applications of the steam engine are discussed. An early form of explosive engine was described in 1826. Medicine was by no means neglected, and in this field the properties of chloroform as an anesthetic were described and the classic work of Dr. Beaumont on the character of the gastric juice presented. Almost from the beginning, probably because of the special interest in it of Silliman himself and the editors who succeeded him, geology and its related sciences have been particularly emphasized, and the editors have with one exception been members of the Yale Department of Geology. Prof. G. P. Merrill, in his history of American geology, calls the Journal "perhaps the most important geological periodical in America." Today it is concerned primarily with problems of geology in the broad sense, but there has never been any formal limitation of its field, and it is still open to contributions from any part of the great realm of science.

Silliman faced many of the same problems that confront modern editors. One of these was whether to make his journal a strictly technical one, thus limiting its support to men of science alone, who were very few in number, or to give it a broader appeal by publishing some material more popular in character. His course is well stated in his own words after 11 years of experience:

The editor of this Journal, strongly inclined, both from opinion and habit, to gratify the cultivators of science, will still do everything in his power to promote its high interests, and as he hopes in a better manner than heretofore; but these respectable gentlemen will have the courtesy, to yield something to the reading literary, as well as scientific public, and will not, we trust, be disgusted, if now and then an *Oasis* relieves the eye, and a living stream refreshes the traveller.

Financial problems were also serious then, as now. Subscribers were not numerous, ranging from 600 to 1,000 in the early years, and many of them often failed to pay their bills! Costs for paper, printing, and engraving were considerable and often exceeded total income, leaving nothing for editorial compensation. Recurring deficits were met by Silliman himself and later by his family and their friends. The Connecticut Academy from the beginning helped in the way of contributions and at least on one occasion gave important financial aid. The Journal has never had a subsidy from any source. For well over a century it was a strictly proprietary one, the property and responsibility of its editors. In 1935 Yale University became its custodian.

Until that year *The American Journal of Science* was a family affair. Benjamin Silliman was its founder and sole editor for 20 years and was closely associated with it until his death. Indeed, the publication was long known popularly as "Silliman's Journal." His son, Benjamin, Jr., joined him as editor in 1838, and in 1846 James Dwight Dana, soon to become the most notable American mineralogist and already Silliman's son-in-law, became a member of the editorial group. The elder Silliman died in 1864, and in 1875 Edward Salisbury Dana, son of James D., was added to the staff. The younger Silliman retired in 1885 and the Danas, father and son, ran the Journal until the former's death in 1895. Edward S. Dana was sole editor until 1926. Thus, for over a century the Journal was in the sole hands of the Silliman and Dana families, whose members assumed not only its grave editorial responsibilities but its financial ones as well. It was well called the "Silliman-Dana family child." The four members of these families who were associated with the Journal were themselves notable investigators and prominent members of the Yale faculty, but their contribution to the scientific life of our country was greatly enhanced by their fatherly care of this ancient and influential publication. It should be remembered that they were also intimately concerned with the foundation and early growth of the Sheffield Scientific School, which has had such an important share in the development of science in the United States.

After Edward S. Dana's retirement, Prof. Alan Bateman and Dr. Ernest Howe were editors, successively, and from 1932 until the present time this responsibility has been in the able hands of Prof. Richard S. Lull.

Beginning in 1851 a group of associate editors was added to the staff. These colleagues, drawn from various fields of science, were available for advice in their specialties, wrote abstracts of important papers published elsewhere, reviewed scientific books, and were otherwise of service, as they still continue to be. Notable among the earlier associate editors were Wolcott Gibbs, Asa Gray, and Louis Agassiz of Harvard, in the fields of chemistry, botany, and zoology; and Brush, Johnson, Newton and Verrill of Yale, in mineralogy, agricultural chemistry, astronomy, and zoology. More recent associate editors have included some of the most distinguished of American scientists.

The volumes of the Journal mirror well the development of science in America. Every great new idea, every fresh field that is cultivated, is there presented. It is interesting, for example, to follow in its pages the progress here of the theory of organic evolution, from Asa Gray's first and rather cautious review of the *Origin of species* in 1860 through the many discussions of this revolutionary idea to the final acceptance of evolution as one of the keys to our understanding of the earth and its history.

During the life of the Journal the organization of science in America has progressed greatly, and scores of new societies and periodicals have been established. Silliman outlines some of the beginnings of this growth in his survey of science in 1847, in which he calls attention to the establishment, 7 years before, of the American Association of Geologists and Naturalists, "composed of individuals assembled from widely separate parts of the Union," and the great service it was rendering. This organization was in a sense the forerunner of the AAAS.

In this Centennial year we are looking backward with gratitude toward the humbler beginnings of the scientific life of America which now flourishes so vigorously and has become such an important part of the life of our Nation and the world. As we do so, we should not forget to pay tribute to the venerable Journal which Benjamin Silliman founded 130 years ago and which for so long has been a notable part of our scientific tradition.

The Progress of Physics From 1848 to 1948

Robert A. Millikan
California Institute of Technology

I HAVE BEEN ASKED TO MAKE a contribution to this Centennial Celebration of the AAAS by some kind of a review of the progress of physics since 1848. In attempting to do so, it is first necessary to provide a picture of the state of science in the United States in the 1840's. I shall try to do this by first quoting a few lines from a recent Atlantic Monthly Press book entitled *New world picture,* by George W. Gray, who, in the following words reflects the state of astronomy in this country at that time. That this picture holds for all the sciences is probable in view of the fact that astronomy is not only the oldest of the sciences, but at all times has been the world over the most generally popular of them all. He says:

In 1832 the English astronomer Airy, in making a report to the British Association on the state of astronomical science throughout the world, remarked that he was unable to say anything about American astronomy because, so far as he knew, no public observatory existed in the United States. It was in the 1840's that the Cincinnati Observatory, the Naval Observatory in Washington, and the Harvard College Observatory in Cambridge, Massachusetts, were founded—the three pioneer institutions in a development that has continued with increasing acceleration ever since. To-day there are more first-class public observatories in the United States than in all the rest of the world, and their equipment is so superior as to make astronomical observation in the twentieth century almost exclusively an American science. For the interpretation of American observations, though, European astronomers and physicists have contributed more than their per capita share—and science is still the great International.

But what was the state of *world* science, as distinct from that of American science, a hundred years ago? Here is my answer to that question: The great foundation, not only of physics but of all the natural sciences and their applications, had been laid in the development following the publication in 1687 of the *Principia* of Galilean-Newtonian mechanics, which by 1800 had made such an impression upon Lagrange, greatest of French mathematical physicists, that he called Newton not only (I quote) "the greatest genius that had ever existed, but also the most fortunate, for there is but one universe and it can happen to but one man in the world's history to be the interpreter of its laws." True, Newton was too great a man to be guilty of such extreme dogmatism (defined as assertiveness without knowledge), for he not only described himself as "like a boy, playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me." He also wrote in his *Opticks*: "The main business of Natural Philosophy is to argue from phenomena without feigning (asserting) hypotheses, and to deduce causes from effects till we come to the very first cause, *which is certainly not mechanical.*"

"To Newton," says the historian of science, Sir William Dampier, "God is immanent in Nature." Lagrange can be excused for being so terrible dogmatist at his date, since he never had a chance to attend a modern symposium on cosmic rays or quantum mechanics. In that sentence I have touched upon what is probably the greatest contribution of physics to human life in our century (1848–1948), namely, the lesson of not extending our working hypotheses with too much cocksureness beyond the range of their experimental verification, for the universe does not lie within the horizon of any mortal, be he scientist or churchman.

Let us return now to other elements of our knowledge of physics in 1848. The wave theory of light had been developed about 1818–20 with matchless skill and completeness by one of France's greatest geniuses, Augustin Fresnel. Again, the foundations for the understanding of electrostatic phenomena had been amazingly well laid by Benjamin Franklin, the most penetrating scientific mind of his time—for what he, altogether without training, contributed in the brief 6 years (1747–53) in which he worked in this field entitles him to rank foremost among American scientists. Volta in Italy (1800) had added notably to the foundations laid by Franklin; Oersted, the Dane (1819), had made the great discovery of electromagnetism; Ampere, the Frenchman, in the 1920's had developed that field with great skill and insight; while England's unsurpassed experimentalist, Faraday, had in 1931 discovered electromagnetic induction and in 1934 had laid the secure foundation for the whole field of electrolysis.

But of the subjects treated in the conventional subdivisions of physics the relations of heat and work and the properties of gases had lagged behind and

were but little understood, though plenty of speculating had been done about them. This was the situation in the whole field of heat effects in spite of the success of the Scotch inventor, James Watt, in producing the steam engine and getting it into practical operation between 1765 and 1782. The existence and rapidly growing use of this engine was responsible for the appearance, in 1824, of one of the greatest scientific advances ever made in physics, namely, the discovery through the use of a new type of reasoning, called reversible Carnot cycles, of the second law of thermodynamics. Its author, at the age of 28, published in that year a small book entitled ***Reflections on the motive power of heat and upon the machines to develop this power.*** In this, Captain Sadi Carnot, who had studied mathematics, chemistry, physics, technology, and even political economy, who was an enthusiast in music and other fine arts and practiced in all sorts of athletic sports, including swimming and fencing, reveals himself also as an original and profound thinker. This book contains but a fragment of his scientific discoveries, but it is sufficient to put him in the very foremost rank though its full value was not recognized until pointed out by Lord Kelvin in 1848 and 1849." This appraisal of Carnot, quoted from the last edition of the *Encyclopaedia Britannica,* introduces us to one of the three stupendous advances in physics (in addition to the birth of the AAAS!) which ushered in the century with which we are concerned in this celebration.

The first of these three advances was the formulation, primarily through the experimental work of Joule which appeared first in 1847, of "The Equivalence of Heat and Work," commonly called the first law of thermodynamics, which was expanded by the reasoning of Kelvin, Mayer, and Helmholtz into the statement of the Principle of the Conservation of Energy—the most far-reaching generalization in the whole range of physical science and one which should always be stated as a working hypothesis, an hypothesis which we can never fully *prove* correct because we shall never be able to test all possible cases.

If the principle of the equivalence of heat and work is assumed, then, as Kelvin showed in 1848, it is possible to *prove* the correctness of the conclusion at which Carnot arrived, namely, the principle that all reversible engines working between the same two temperatures must have the same thermodynamic efficiency. This second law of thermodynamics is sometimes called "The Principle of Entropy." The introduction into our modern languages of the words "energy" and "entropy" as sharply defined physical concepts was due primarily to the work of Joule, Kelvin, Mayer, and Helmholtz at the very beginning of the century 1848–1948.

The third of the great advances referred to above as coming in with our century was the appearance of the first definite quantitative evidence through the analysis of Joule in England and Clausius in Germany for the correctness of the Kinetic Theory of Gases. This work of Joule and Clausius on the kinetic theory, coming in at the very opening of our century, began to give physicists confidence in the validity and usefulness of the atomic and kinetic postulates underlying the kinetic theory. That confidence was increased by the appearance about 1865 of a notable paper by James Clerk Maxwell in which he showed that the kinetic theory required that the viscosity of a gas within wide limits should be independent of its density or pressure. At first sight this looked like an impossible result, quite contrary to common sense, but Maxwell devised an experiment which proved that the requirements of his theory were met experimentally and quantitatively, too. This introduces James Clerk Maxwell to the century on review today. *He was its greatest ornament*—probably the greatest analytical mind since Newton. He and his electromagnetic theory dominated all the rest of the 19th Century. He first advanced his electromagnetic theory in a paper which appeared in 1867, but elaborated it in his book, *Electricity and magnetism,* published in 1873. In this he predicted what we now call radio waves and proved that light was only short wave-length waves of this sort.

In 1888 Heinrich Hertz first produced such radio waves in his laboratory at Karlsruhe and found that their speed of transmission was the same as that of light, as it had to be if Maxwell's theory was correct. Helmholtz, at the University of Berlin, began at once a course of lectures on the applications of the electromagnetic theory to optics. Drude, one of Helmholtz' pupils, following the outline of Helmholtz' lectures as filtered through his own mind, wrote a book entitled *Physik des Aethers* (1897), which Riborg Mann and I translated into English. Maxwell's theory was spread through agencies of this sort and became the chief subject of study in the world's physical and electrical engineering laboratories, so that it is not too much to say that Maxwell's book has created the present age of electricity in much the same way in which Newton's *Principia* created, a hundred years earlier, the mechanical age in which we are still living. Probably no books have ever exerted so large an influence on the life of man on earth as have these two.

Turn now from the fields of thermodynamics and electrodynamics, with their infinitude of applications to the life of man, to the field of relativity, which has had few, if any, immediate applications to the everyday life of mankind. It, too, is a product of the century under review. It was in 1888, when Hertz

was testing out Maxwell's theory of electromagnetic waves, that Michelson and Morley were making in Cleveland their famous ether drift experiment, in which they found no trace of a relative motion of the earth through the ether, or through space, if one prefers that form of statement. The generalization of the negative results of that experiment is the origin of the relativity theory. One of the most important consequences of the experiment has been to convince us all that *we did not know as much about the universe as we thought we did.* We have tried to reconstruct our universe so that there will not be any contradictions left in it, but we have woefully failed in the attempt, and possibly that knowledge *about our limitations* is just as useful for our intelligent and satisfying living as the practical knowledge we obtained from our studies in thermodynamics and electrodynamics. I shall return to this question after considering some other discoveries of our century that have been made since 1895.

The first four of these are (1) the discovery of X-rays by Roentgen in December 1895, (2) the discovery of radioactivity by Becquerel in Paris in 1896, (3) the demonstration to the satisfaction of physicists generally, by J. J. Thomson in England in 1897, of the concept of the electron as a fundamental constituent of all the atoms in the universe, and (4) the discovery of "quanta" by Planck in Berlin in 1900.

Of these four discoveries, the electron has been the most useful to mankind, for there is scarcely an industry that does not use it, and many new industries have been created by it. Radioactivity has been the most spectacular of the four, the most startling to human thought, and the most stirring to human imagination, for it destroyed the idea of the immutability of the elements and showed that the dreams of the alchemists might yet come true.

Planck's discovery of quanta had the most profound influence of any of the other three discoveries upon the fundamentals of physics. It was not revolutionary in undoing the past. The old laws still held *in the field in which they had been experimentally tested.* The reason the discovery had not been made earlier is that man was here entering an almost completely unexplored domain of the very existence of which he had thus far scarcely dreamed, namely, the domain of subatomic or microscopic, as distinguished from ordinary or macroscopic, energy or momentum exchanges. Practically the whole of our lives is still spent in the macroscopic world of ordinary, large-scale phenomena, in which energy exchanges are continuous processes described by differential equations and governed by the established laws of Galilean-Newtonian mechanics. In the discovery of quanta, man entered for the first time a new atomic, or microscopic, world in which *continuous* changes, with their laws, no longer rule, but where instead, all energy exchanges represent sudden, discrete energy jumps that we call "quanta," defined by the product $h\nu$, where h is a universal constant called "Planck's h" and ν is the frequency of the vibration involved. Planck was led to his announcement of the theory of quanta through a whole series of results obtained mainly in Germany, first by Vienna's greatest physicist, Boltzmann, in 1884 on the law of so-called black-body or "cavity radiation" (the Stefan-Boltzmann law); second, by the German physicist, Wien, on the Wien displacement law (see *Wied. Ann.,* 1896, **58**, 662). Both these laws follow necessarily from thermodynamic reasoning applied to cavity radiation. Third came Lummer and Pringsheim's experimental studies at the Berlin Reichsanstalt (1897–99) on the actual distribution of radiant energy between the different wave lengths in black-body radiation, and fourth, the combination of these results, showing that the "principle of equipartition" could not apply to black-body radiation and that *quanta* were the only way out of the difficulty.

The next three important discoveries of our century were made by Rutherford in 1911, by Moseley in 1914, and by Bohr in 1913. All of these relate to the microscopic, not the macroscopic, world and therefore find their utility only in increasing man's understanding of the way the world in which he lives does its day-by-day business. The discovery, made in 1914 by Moseley, a brilliant young Englishman who lost his life at Gallipoli in World War I, consisted in proving that there neither are nor can be more than 92 different stable elements, all of which have from 1 up to 92 positive unit-charges on their minute central nucleus and which therefore can hold from 1 up to 92 satellite negative electrons circling about that nucleus. Moseley therefore simplified our whole understanding of atomic constitution by introducing as the unique and distinguishing characteristic of a given atom its *atomic number* in the complete sequence extending from 1 up to 92. At the age of 27 he had accomplished as notable a piece of research in physics as had appeared in 50 years.

The Rutherford discovery of 1911 was the discovery of the nuclear atom itself, utilized after its discovery by Rutherford in Moseley's researches. In 1903 Rutherford had already done more than any one physicist to clear up and reduce to order the complicated mass of radioactive data and thus reduce radioactivity to an orderly and quite-well-understood science. He did a similar job for the structure of the atom in 1911, demonstrating by straightforward analysis what the structure of the atom had to be to account for the way it acted upon alpha particles

shot through it. He did a third great job in 1919, when, using alpha particles as his bullets, he produced the first artificial disintegration of atoms by knocking protons out of nitrogen, aluminum, and phosphorus. He was an indefatigable worker himself, and he was a great director of three laboratories—one at McGill University in Canada; one at Manchester, England; and one at Cambridge, England.

Rutherford made no use of quanta in arriving at his picture of the Rutherford nuclear atom, which was simply a small central nucleus carrying a number of unit positive charges determined by, and equal to, the *atomic number* of the atom.

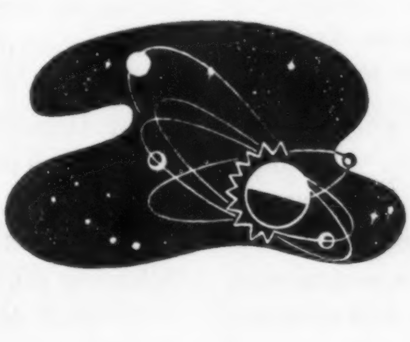
Bohr, on the other hand, devised an atom which could emit or absorb radiations in all its atomic shells, and each such emission or absorption represented a quantum jump from one of a whole series of quantized orbits to another. In other words, it was an atom designed to handle the emission of line spectra; it was a *spectroscopic* atom. When it was devised, spectroscopy was a veritable dark continent in physics. With the aid of the Bohr atom the dark continent in physics has become the best-explored, the best-understood, and the most civilized portion of the world of physics. It has been an exciting game of exploration to which a whole group of the ablest young men in physics have contributed—men like Chadwick, discoverer of the neutron; Pauli, of "Pauli's exclusion rule" fame[1]; and Bowen, who brilliantly solved the century-old riddle of the nebulium lines and demonstrated that these mysterious lines are all merely "forbidden lines," corresponding to electronic jumps in common atoms like carbon, nitrogen, oxygen, which jumps cannot take place while the atoms are participating in collisions frequently occurring between them and their neighbors, but can take place in the essential absence of collisions such as is to be expected in outer space or in tenuous nebulae. Mysterious nebulium thus became ordinary carbon, nitrogen, and oxygen.

Because of space limitations I have not treated Carl Anderson's discovery of the positron, Anderson and Neddermeyer's discovery of the mesotron, just now brought prominently to the fore in all cosmic-ray discussions, and I have left unmentioned many pieces of work of equal importance with those I have discussed. I close my review of the last hundred years of physics with the discovery suggested by Einstein in 1905 but brought to fruition only in the 1940's.

The foregoing four discoveries of the period from 1895 to 1900 were followed in 1905 by Einstein's even greater discovery of the relation between mass and energy, namely, $E = mc^2$, E being energy in ergs; m, mass in grams; and c, the speed of light in centimeters. This discovery suggested the possible answer to an age-old mystery—how the sun could have maintained his outflow of heat for billions of years when, if he were just a hot body cooling off, or even if he were made of carbon and oxygen in the proper proportion for burning, he could not possibly have maintained his heat output for more than a few thousand years. But the foregoing equation showed that if there were any way by which he could burn up his own mass, in view of the enormous size of the factor c (3×10^{10} cm), he could maintain his present output of heat for very many billions of years. The physicists now feel very confident that this is exactly how the sun keeps his furnaces going, namely, by the conversion of a suitable portion of his own mass into radiant energy. This discovery outranks all others in its relation to the destiny of man, for if he can make this kind of a process take place on earth—and we now know that to a limited extent he can do so, as the atomic bomb in 1945 demonstrated—then he can at least destroy himself. It is possible also that he can use it only for beneficent purposes, so that it is not exaggerating to say that this is the most significant, the most fateful discovery that mankind has ever made. It was suggested as a possibility by Einstein in 1905, but first proved practically in 1945,[2] just at the end of the first century of existence of the AAAS.

[1] This states that in a given atom two electrons cannot occupy one and the same electronic position.

[2] I have discussed this discovery and its possible consequences at length in Chapter XVI, entitled "The Release and Utilization of Atomic Energy," in the last edition of a book published in 1947 by The University of Chicago Press.



The National Academy of Sciences and the National Research Council

Raymund L. Zwemer, *Executive Secretary*

THE NATIONAL ACADEMY OF SCIENCES has been from its origin closely associated with the American Association for the Advancement of Science, and both of them with the Smithsonian Institution, which was founded somewhat earlier "for the increase and diffusion of knowledge among men."

Just a hundred years ago the American Society of Geologists and Naturalists broadened its scope to become the American Association for the Advancement of Science, several members of which in turn were instrumental in helping to establish the National Academy of Sciences.

In connection with the Centennial Celebration of the AAAS it is interesting to note that 11 of the 15 presidents of the National Academy were also presidents of the AAAS, and, of the 97 presidents of the AAAS, 84 are on the rolls of the Academy.

It was at a meeting of the AAAS in 1851 that Alexander Dallas Bache, grandson of Benjamin Franklin, pointed out in his retiring presidential address that "an institution of science supplementary to existing ones is much needed in our country to guide public action in reference to scientific matters." A further quotation from this address is as pertinent today as it was then:

> Our country is making such rapid progress in material improvements that it is impossible for either the legislative or executive departments of our Government to avoid incidentally, if not directly, being involved in the decision of such questions. Without specification, it is easy to see that there are few applications of science which do not bear on the interests of commerce and navigation, naval or military concerns, the customs, the light-houses, the public lands, post-offices and post-roads, either directly or remotely. If all examination is refused, the good is confounded with the bad, and the Government may lose a most important advantage. If a decision is left to influence, or to imperfect knowledge, the worst consequences follow.
>
> Such a body would supply a place not occupied by existing institutions, and which our own is, from its temporary and voluntary character, not able to supply.

Twelve years later, in February 1863, Joseph Henry, secretary of the Smithsonian Institution, Alexander Dallas Bache, superintendent of the Coast Survey, and Charles H. Davis, chief of the Bureau of Navigation, Navy Department, were named as a commission to report on various matters of science and art, but chiefly of a practical import and relating to the physical sciences. Davis' letter of appointment is preserved in the archives of the Navy Department. The members of this commission were active, in consultation with others, in forming a plan for a National Academy of Sciences which would have the dual nature of honoring members elected to the group and of serving as adviser to the Government. The plan culminated in an Act of Congress which was passed by the Senate and by the House of Representatives and signed by President Abraham Lincoln—all on Tuesday, March 3, 1863.

In carrying out subsequent requests of Federal government agencies for advice from the Academy, it was found that many problems required the combined action and thoughts of a specific group of people. Committees were therefore named, and a brief mention of some of these may be interesting as illustrations of the questions presented.

Advice was requested on weights, measures, and coinage. A committee on this subject is still in existence and has been called on from time to time. Other committees dealt with metric standards for the states; with philosophical and scientific apparatus; with protection of the bottoms of iron vessels; with magnetic deviation in iron ships; with the astronomical day, the solar eclipse of 1886, and the erection of a new naval observatory; and with questions on meteorological science and its application. The Department of State requested an Academy committee to look into the matter of restoration of the faded writing of the original manuscript of the Declaration of Independence. As a result of the report of this committee the manuscript was removed from exhibition in 1893, sealed between glass plates, and placed in a steel safe, where it was no longer exposed to light and was secure from careless handling.

The Department of Agriculture requested committees on silk culture and on sorghum sugar, which was suggested as a substitute for the then-scarce cane sugar.

The Department of the Interior in 1896 requested information on a rational forest policy for the forested lands of the United States. An official expression from the National Academy was requested upon the following points:

(1) Is it desirable and practicable to preserve from

fire and to maintain permanently as forested lands those portions of the public domain now bearing wood growth for the supply of timber?

(2) How far does the influence of forest upon climate, soil, and water conditions make desirable a policy of forest conservation in regions where the public domain is principally situated?

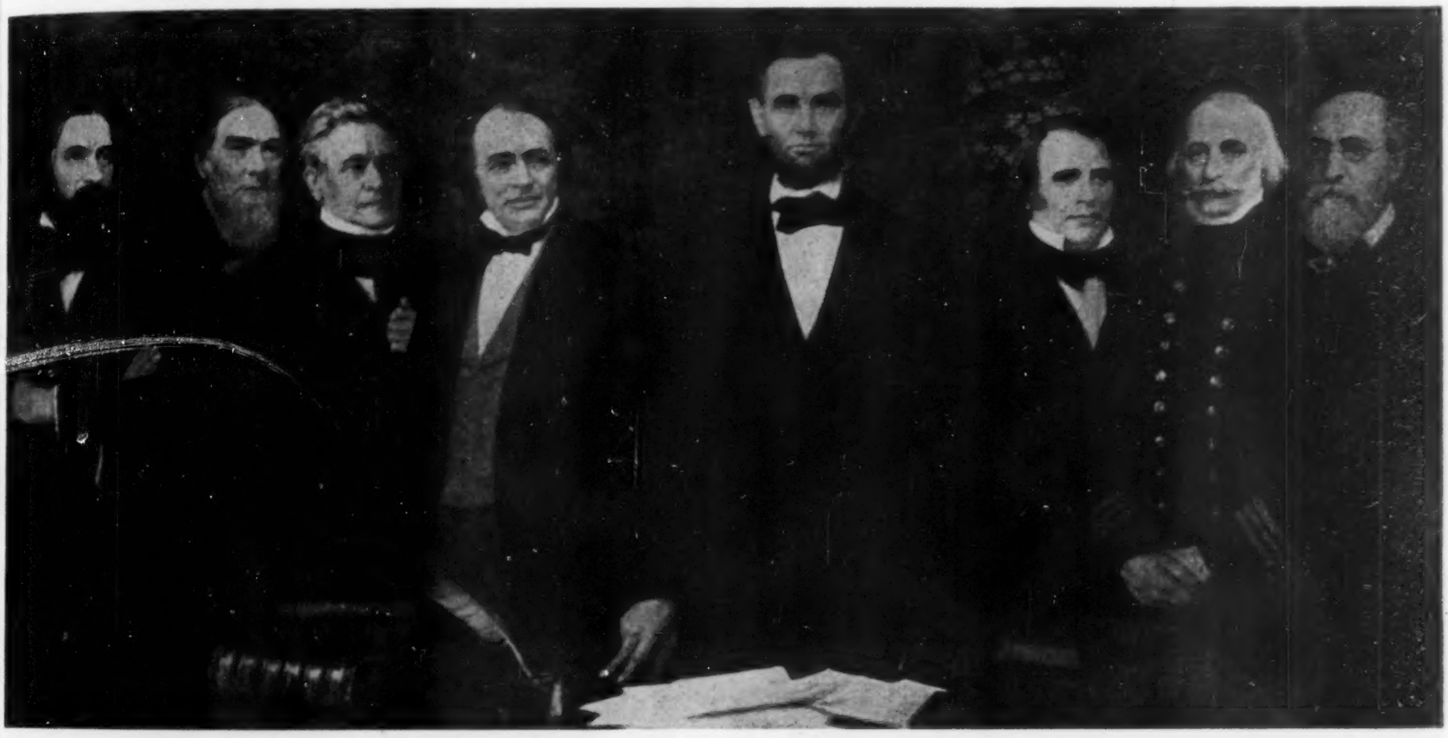
(3) What specific legislation should be enacted to remedy the evils now confessedly existing?

The members of the committee appointed spent three months in laborious study and inspection of forests and found widespread devastation caused by fires started by careless or ignorant campers or hunters, devastation by herds of animals, and theft of timber. The preliminary report to the Secretary of the Interior recommended the establishment of 13 new forest reservations covering more than 21,000,000 acres. The report was forwarded to President Cleveland on February 6, 1897, and on February 22 the President proclaimed the establishment of these reservations. The full committee report on the inauguration of the forest policy was comprehensive in scope and contained definite recommendations for the establishment of a National Forestry Service.

Soon after the organization of the National Academy of Sciences, Alexander Dallas Bache added a codicil to his will leaving a trust fund, the income of which should be for the "prosecution of researches in physical and natural science by assisting experimentalists and observers in such manner and in such sums as shall be agreed upon by the board of direction in the said clause named." The first grant for scientific research was made in 1871 to Prof. J. E. Hilgard in connection with the magnetic survey of the United States. The chairman of the trust fund committee was Joseph Henry. Through this fund and subsequent bequests, the Academy has been given an important instrumentality for the promotion of scientific research. There are now 8 Trust Funds of the Academy which give grants; additional ones have been established for the awarding of medals and honoraria for distinguished research.

Notable contributors to the advancement of science in this and other countries are honored by the awarding of medals and prizes.

Stress of war brings problems soluble only by scientific research, and successful research requires trained investigators. In April 1916, when the entry of the United States into World War I was being foreseen, the National Academy of Sciences offered its services to the President of the United States. The result of this offer is appropriately given in the words of George Ellery Hale, who did so much in the establishment of the National Research Council:



The founders of the National Academy of Sciences as painted by Albert Herter. Left to right: W. B. Patterson, A. D. Bache, Joseph Henry, Louis Agassiz, Abraham Lincoln, Senator Henry Wilson, Admiral Charles H. Davis, and B. A. Gould.

> President Wilson at once requested that steps be taken to organize the research agencies of the country, not solely with respect to the necessities of possible war, but also because of the importance of developing and utilizing them more effectively under peace conditions. This led to the establishment in September 1916 of the National Research Council, a federation of governmental, educational, privately endowed, and industrial research agencies, resting upon the charter of the National Academy, and extending the scope of its activities into every branch of the mathematical, physical, and biological sciences, and their applications to engineering, medicine, agriculture, and other useful arts.

Thus our National Research Council differs fundamentally in several respects from the Advisory Councils for Scientific and Industrial Research recently established by the British, Australian, and Canadian Governments, though its general objects are similar to theirs. Those Councils are branches of the Government, with officers appointed by the party in power and thus subject to political influences and exigencies. The National Research Council is closely connected with the Government, through the charter of the Academy and the Executive Order issued by President Wilson on May 11, 1918, which provides for the cooperation of Government Departments, and for the appointment by the President of representatives of their scientific and technical bureaus to membership in the Research Council on the nomination of the National Academy of Sciences. The constitution of the Research Council is determined, however, by the National Academy, and this assures its scientific soundness. Moreover, the scheme of organization adopted by the Academy provides that the several divisions of the Research Council shall be made up of nominees of leading national scientific and technical societies interested in research. This gives the Council a thoroughly representative character, and makes it an actual federation of research agencies. Thus it is peculiarly well fitted to secure the cordial cooperation of the numerous elements that must work in harmony, if extensive plans for cooperation in research are to be carried into effect.[1]

For two years the Research Council acted as an emergency or a temporary organization to assist the Government in coordinating the scientific resources of the country. On May 11, 1918, by Executive Order, the President requested the Academy, in view of the new and important possibilities of science and research in time of peace as well as war, to establish the Council on a permanent basis. The purposes of the Council can best be expressed by the Executive Order itself.

Meeting of the National Academy of Sciences in Mineral Hall, Smithsonian Institution, about 1871: 1, Joseph Henry; 2, Mary Henry; 3, W. J. Rhees; 4, F. W. Clarke; 5, J. S. Newberry; 6, J. C. Dalton; 7, J. E. Hilgard; 8, J. J. Woodward; 9, Peter Parker; 10, Alfred M. Mayer; 11, William Ferrel; 12, Benjamin Silliman; 13, C. E. Dutton; 14, Emil Bessels; 15, Arnold Guyot; 16, J. H. C. Coffin; 17, B. A. Gould; 18, Elias Loomis; 19, C. A. Schott; 20, George Eugelmann; 21, Benjamin Peirce; 22, Simon Newcomb; 23, Lewis H. Morgan; 24, A. A. Michelson; 25, John S. Billings; 26, Weir Mitchell; 27, Frederic M. Endlich.

Executive Order

The National Research Council was organized in 1916 at the request of the President by the National Academy of Sciences, under its congressional charter, as a measure of national preparedness. The work accomplished by the Council in organizing research and in securing cooperation of military and civilian agencies in the solution of military problems demonstrates its capacity for larger service. The National Academy of Sciences is therefore

[1] From *The national importance of scientific and industrial research*, by George Ellery Hale and others.

requested to perpetuate the National Research Council, the duties of which shall be as follows:

1. In general, to stimulate research in the mathematical, physical and biological sciences, and in the application of these sciences to engineering, agriculture, medicine and other useful arts, with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare.

2. To survey the larger possibilities of science, to formulate comprehensive projects of research, and to develop effective means of utilizing the scientific and technical resources of the country for dealing with these projects.

3. To promote cooperation in research, at home and abroad, in order to secure concentration of effort, minimize duplication, and stimulate progress; but in all cooperative undertakings to give encouragement to individual initiative, as fundamentally important to the advancement of science.

4. To serve as a means of bringing American and foreign investigators into active cooperation with the scientific and technical services of the War and Navy Departments and with those of the civil branches of the Government.

5. To direct the attention of scientific and technical investigators to the present importance of military and industrial problems in connection with the war, and to aid in the solution of these problems by organizing specific researches.

6. To gather and collate scientific and technical information, at home and abroad, in cooperation with governmental and other agencies, and to render such information available to duly accredited persons.

Effective prosecution of the Council's work requires the cordial collaboration of the scientific and technical branches of the Government, both military and civil. To this end representatives of the Government, upon the nomination of the National Academy of Sciences, will be designated by the President as members of the Council, as heretofore, and the heads of the departments immediately concerned will continue to cooperate in every way that may be required.

(Signed) Woodrow Wilson

The White House
11 May, 1918

An appreciable part of the war work conducted by the Council or under its auspices did not terminate in 1918 but was continued for longer or shorter intervals, and some of the committees are still operative, having been assimilated into the peacetime organization. This was peculiarly true of those whose work was most closely related to industrial problems, many of which are quite as significant for times of peace as for war. Certain metallurgical researches which were continued under the Division of Engineering are cases in point.

The membership of the Research Council, numbering about 220, is now composed largely of appointed representatives of more than 90 of the major scientific and technical societies of the country, together with representatives of certain other research organizations, representatives of government scientific bureaus, and a limited number of members-at-large. These members receive their appointments from the President of the National Academy of Sciences. Representatives of the government executive agencies are appointed with the approval of the President of the United States.

Many projects which contributed directly to the successful conclusion of World War II were financed through contracts made with the Office of Scientific Research and Development, the War Production Board and other government departments and agencies. Important projects undertaken included military medicine involving extensive cooperation with the Committee on Medical Research, food and nutrition, research on critical metals and other materials, and certain problems of actual warfare, many of them highly confidential.

The National Research Council administers a large number of fellowships generously supported by organizations such as the Rockefeller Foundation, the American Cancer Society, Merck & Company, Inc., the Radio Corporation of America, the National Foundation for Infantile Paralysis, and, most recently, by a large grant from the Atomic Energy Commission.

Neither the Academy nor the Research Council receives appropriations directly from the Government. Support for the central organization and maintenance of the building and grounds is derived from an endowment which was a gift of the Carnegie Corporation. Special projects are financed by contracts with government agencies, nonprofit philanthropic organizations, and foundations. Grants-in-aid of research are available from a number of Trust Funds and from some of the resources enumerated above.

The National Science Fund was established by the National Academy of Sciences in April 1941. The Academy receives, and the National Science Fund applies, large or small gifts for all physical and biological sciences. The Fund also offers its services as adviser to any prospective donor to science.

Giving money wisely is not a simple task. This is particularly true of support for fundamental scientific research. Recognition of this fact led to the establishment of the National Science Fund, which offers an organization controlled by a Board of Directors composed of distinguished scientists and qualified laymen to help donors to give wisely and usefully for the advancement of science.

The *Proceedings* is the official organ of the National Academy of Sciences and of the National Research Council for the publication of brief accounts of im-

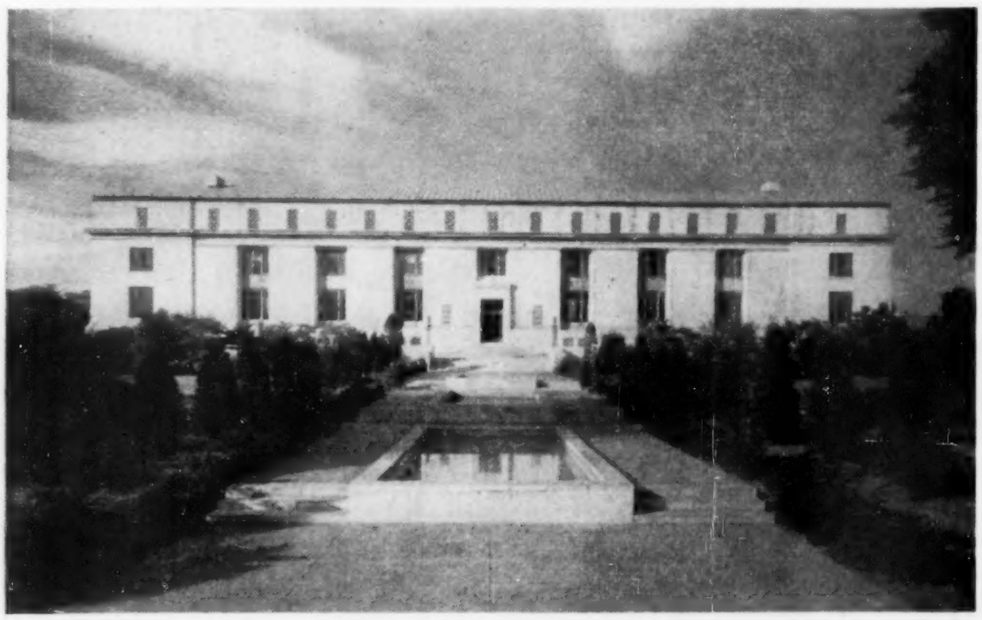
portant current research of members of the Academy and of the Council, and of other American investigators. Larger contributions to knowledge have been issued as *Scientific Memoirs,* among which might be mentioned "Report of the Eclipse Expedition to Caroline Island," "On the Temperature of the Surface of the Moon," "The Cave Fauna of North America," "The Solar and Lunar Spectrum," "Contributions to Meteorology," "Catalogue of the Meteorites of North America to January 1, 1909," "Studies Upon the Life Cycles of the Bacteria," "Panama Canal Slides," and many others.

The Academy has also sponsored, together with the Research Council, publication of a number of books, some of which have attained the rank of best sellers.

The *Biographical Memoirs* furnish much of human interest to the historical records of the Academy.

in 1924. The land on which it stands was purchased with funds subscribed by about 20 friends of science, and funds for its erection were provided by the Carnegie Corporation.

The building is of white Dover marble, trimmed in bronze. Over the doorway is a representation of the elements with which science deals—earth and cloud, and the various forms of vegetable and animal life to man; at the apex is the sun, source of warmth and light. Bronze panels on either side of the doorway and pierced stone window grills have woven into the scroll pattern the initials NAS and NRC, indicating the joint occupancy. The cornice of the building is composed of alternating figures of the owl and the lynx, typifying wisdom and alert observation, with a coiled serpent at each corner. The bronze window panels depict the progress of science from Greek to



The Academy Building

modern times by means of a succession of the great founders. The bronze doors portray 8 episodes in the history of science from Aristotle to Pasteur.

No scientific laboratories are maintained by the Academy or Research Council. Instead, they seek to coordinate the work of individual scientists and laboratories dealing with large problems in the fields of science. Among the means of carrying out these aims are conferences, technical committees, surveys, sponsorship of new organizations for research and of scientific publications, and the administration of funds for research projects.

This brief description of the very complex structure and function of the National Academy of Sciences and the National Research Council will, it is hoped, serve to remind the reader of the part these organizations have played in the development of science in this country during much of the past 100 years.

The National Research Council issues a series of Bulletins giving general sources of scientific knowledge; directories of research laboratories and personnel and of scientific societies and their officers; reports upon the status of various fields of research; and special contributions of an original character. Its Reprint and Circular Series is for less extensive papers and for reprints of timely articles, some of which have had initial circulation elsewhere.

The activities of each year, reported by the president of the Academy, the chairman of the Research Council, and the chairmen of Divisions of the Research Council, are contained in an Annual Report submitted to Congress through the president of the Senate.

The building of the National Academy of Sciences and National Research Council, which was designed by the late Bertram Grosvenor Goodhue, was completed

The Rise of Science Understanding

Watson Davis, *Director,*
Science Service, Washington, D. C.

NONE OF US CAN KNOW FIRSTHAND the happenings of a century or realize with the vividness of recent years the feelings and ideas of days before our time.

Upon my bookshelf there is a leather-bound, fox-leaved little book, *Elements of natural philosophy,* printed in 1808 in Philadelphia. Perhaps I should not have told you the date, so modern-sounding is the preface:

> The great object of science is to ameliorate the condition of man, by adding to those advantages which he naturally possesses. . . . If, then, philosophical knowledge be of such essential advantage in the general pursuits of society, it surely becomes highly expedient to diffuse it in such a manner, as to enable every class to obtain some portion of the whole.

This was two generations before the beginnings of the American Association for the Advancement of Science. And there was then nothing new in the idea that people should understand science. Great discoverers of earlier years, Copernicus, Newton, Franklin, and many others, had to tell what they had learned in words that could be understood by those who did not know what had been discovered. The classic discoveries were, of necessity, in many cases "popularized" in their first telling.

But today *is* different from yesterday.

The popularization or interpretation of science, as it is broadly understood today, is as modern a phenomenon as the newspaper, radio broadcast, television program, movie, or slick picture-magazine articles of today.

Something has happened to the public's attitude toward science and the scientist's attitude toward the public. Those in their 20s may date the change from Hiroshima. But the new approach to science understanding is an older phenomenon that antedates the fission of uranium. It goes back to the intellectual burst of realization that this is a scientific world in which we live—a slow-moving explosion that was touched off by the airplane, the radio, appreciation of sanitation and immunization, snatching of nitrogen from the air, the chemical revolution, and a score of other scientific achievements. It is dated by World War I.

The public is never in the vanguard of scientific progress, just as the body of scientific opinion can never keep pace with the great, creating pioneers. The man in the street cannot be told about the achievements of science until they happen. If we are tempted to criticize the newspapers of 1903 for not putting banner headlines on the first Wright Brothers flight, remember that Orville and Wilbur were not willing to shout the news themselves from the cloudtops.

The public must not be too far behind. Today public knowledge and appreciation often treads on the heels of the researcher. Seldom does science trip for that reason.

The pace in the prewar days—and you can choose your own war, Civil, Spanish-American, World War I, or World War II—was not as swift as it is now. The lag between discovery and effective public knowledge was seemingly longer. This interval between the discovery of new knowledge and its application—presuming it has practical application—is one of the variable, unknown factors, difficult to measure. It is like the development period between the issuing of a patent and its successful commercialization, which most inventors will ruefully claim approximates the 17-year period of patent grant.

Perhaps we are closing the time gap between discovery and use. Certainly, $2,000,000,000 and several thousand scientists did some gap-closing in the case of uranium fission during the recent war.

We must not be complacent because we can reach 99,000,000 people with sound and bulletin a thousand high-speed presses any hour of the 24. There are millions (in the U.S.A.) who may mouth science and scientific jargon, yet they do not understand the methods of science, much less practice them.

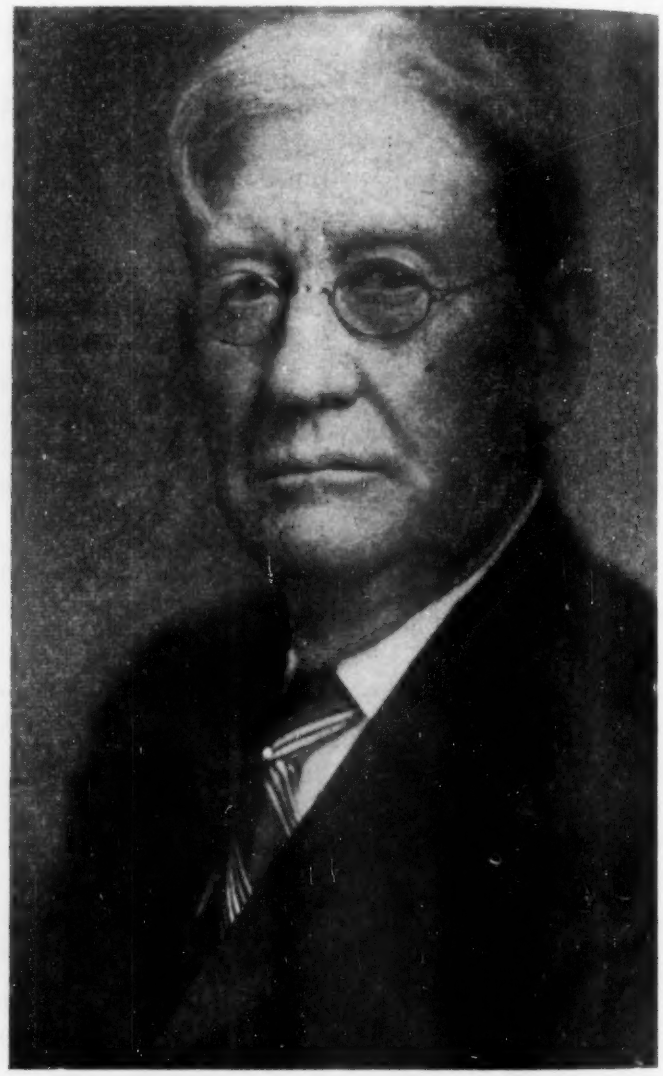
It is a hard, intelligent, and rewarding task to give the people opportunity to understand. Every year there is a new audience, eager and receptive if their inquisitiveness is not rubbed off by dull, didactic teaching. Always the old to some is the new to many. Perhaps it has often been so. We like to believe that there is now more opportunity to understand than ever before.

About a hundred years ago, gold was discovered in California, the Smithsonian Institution got under way, and the AAAS was organized. Social ferment was abroad in the land, to fester a decade or so later into a bloody war. It was, as always, the ending of an era and the beginning of an era.

In the decades that followed, the books and lectures predominated in taking science to the people. Look back over the rows of early AAAS reports, the famous Smithsonian reports that were virtual science yearbooks, and the great books that carried the new formulations to scientist and intelligent gentleman alike. Darwin's *Origin of species* sold out the first day of issue, you remember.

ideas of enterprising editors and, in a very real sense, the popular knowledge of the times. There was a running feud between scientist and reporter, in almost all cases. The scientist could not trust the reporter, who did not try to understand. The reporter often used his malicious imagination instead of taking the trouble to understand, and the scientist did not try to persuade the reporter to understand.

E. W. Scripps



W. E. Ritter

In the mode of the pulpit, the early scientists were also speakers who carried their messages directly to the people from the lecture platform—not all of them, of course, but an impressive number, comparatively. Then, too, there were the professionals, the Chautauqua speakers. Even the pulpit helped, for the well-ballyhooed conflict betwen science and religion was good advertising for science, in the long run, as well as an ever-fresh text for the preachers. One of the last gasps of this controversy, the Scopes trial at Dayton, Tennessee, in 1925, was of educational value to the public.

The newspapers of those days covered science as they did other matters—sometimes well, sometimes badly. There was sensational pseudo-science to fit the

There were some creditable reports of scientific gatherings. About the turn of the century, Dr. Charles Edward Munroe, the great explosives chemist (whose "effect" was used in the bazooka), turned out several newspaper columns a day on one important meeting in Boston, if I remember correctly. If the old-timers were alive, they could tell us more such instances.

But there was no sustained effort at taking science to the public.

The modern era of science popularization dates from the end of World War I, when the shock of TNT awoke scientists and public alike to the effectiveness of science. It is a happy fact that an era of good feeling between scientist and newspaperman was

achieved and made effective during the decade that followed that war. And it is significant and appropriate that the hands of good fellowship of science and the press were extended simultaneously in such a way that scientists and editors have been able to work together.

The implications of this pooling of interests by the public and the world of science extends far beyond the mere implanting of scientific facts into the minds of laymen or the replacement of so many newspaper columns of crime, politics, or other news by scientific news. It transcends the securing of adequate support for scientific research, important as that is. Science reporting and interpretation does not accomplish its purpose—the principal purpose of science popularization—if it does not bring about an appreciation and a utilization of the method of science in everyday life.

I have a firm conviction that this cannot be done didactically or even by consciously setting out to do it. I believe the most powerful method of getting across any idea is by example. If the great mass of the people, through accurate and interesting accounts of the successes and failures of science, can glimpse and understand that essence of science, its trying, testing, and trying again, if they build their own convictions that this is a good, sensible, successful, and useful method, then there is hope that they will apply it more widely to everyday life, to our human relations, to running our businesses, to our governments, to everything that we do. So many of the ideals that we cherish, such as liberty, opportunity, the pursuit of happiness, freedom, democracy, are achieved by the utilization of scientific methods. The ways of science and democracy may at times seem roundabout and slow, but they are usually more sure and safer. The mistakes of science and democracy are best corrected by the methods of science and democracy.

It is this philosophy and plan of action that lies, historically and actively, at the roots of Science Service.

Let us turn back to 1919, a year after the Armistice, when the world was sobering up from the debauch of war, realizing that there is something more real and powerful than the rule of might, even in a righteous cause.

Two men, one a great newspaper man, the other a great biologist, were the progenitors of what is now Science Service.

E. W. Scripps had founded and guided to success the great group of newspapers that bears his name; he had created press associations and syndicates to supply them with news and features. Yet he saw the need of something that his enterprises lacked. In planning and materializing the new institution he turned to Dr. W. E. Ritter, University of California biologist, his fellow philosopher and fellow student of nature and man.

What was in these two minds at that time? Dr. Ritter has told me of one of Mr. Scripps' earliest statements of his conception of Science Service. It is useless, E. W. argued, to think of making the world safe for democracy without thinking also of making democracy safe for itself. And both Scripps and Ritter were convinced that the only possible way of making democracy thus safe is to make it more intelligent. Since to be intelligent is utterly impossible without having much of the knowledge, method, and spirit of science, it followed that the only way to make democracy safe is to make it more scientific. And that is what they set out to do.

Mr. Scripps and Dr. Ritter visualized what they at first called the "American Society for the Dissemination of Science," and they set to work to bring it into being. Dr. Ritter became missionary and expositor. He visited the intellectual centers of America to urge the cooperation of scientists in this liaison agency between science and the press. He met with some skeptics and with some who believed science to be above the average man. He was, nevertheless, successful. Science Service was organized two years later, in 1921, with trustees nominated by three scientific groups, the National Academy of Sciences, the National Research Council, and the American Association for the Advancement of Science, and two newspaper groups, the E. W. Scripps Estate and the journalistic profession.

Science had formally backed the ambitious infant organization. Science Service then had a double task: first, selling to the American newspapers the idea that science is news, good news, news that can compete, from a circulation standpoint, with crime, politics, human comedy and pathos, and the conventional array of news and feature; second, it had to sell and distribute the popular science material it produced.

We have the bound record of material sent out to newspapers over the years, of the successful and unsuccessful experiments in tailoring a product that newspapers would want to print and pay for at nominal rates.

One of the first things that Science Service did was to produce a news service that it distributed directly to newspapers under the now-familiar "By Science Service" label. In 1921 it was a mailing once-a-week. Now our leased wire service spans the continent, delivering about 800 words a day, and this is backed up by mail copy, under release date ("wire by mail" we call it), a weekly feature page, and other features. We reach a couple of hundred newspapers and other publications with a readership of about 10,000,000.

The first director of Science Service, until his death in 1929, was Dr. Edwin E. Slosson, chemist, a superlative popularizer by pen and voice, whose great book, *Creative chemistry*, had a predominant influence upon the public appreciation of chemistry and the prestige of that science in those days. Dr. Slosson came to

Edwin E. Slosson

head Science Service from the literary editorship of the old *Independent* magazine. It was a great privilege to work with him in Science Service's beginnings.

Our offices in those days were in the old residence rented by the National Research Council at 1701 Massachusetts Avenue, since replaced by a swanky apartment house. We used to say that Science Service material was conceived in the maid's bedroom and born in the butler's pantry, for those were the locations of the office and the mimeograph. Science Service joined the National Academy of Sciences and the National Research Council when their monumental building on Constitution Avenue was erected. Just at Pearl Harbor time, Science Service occupied its own building at 1719 N Street, N.W., not distant from the present headquarters location of the AAAS.

If one views the extensive and sympathetic play that science gets in press, magazine, and radio today, it is hard to realize that not long ago the scientist to the cartoonist was a funny old man with a beard and the way to report a scientific meeting was to pick out the big words in the program and write a funny story. When Science Service was young, that was the conventional method of handling science in the press.

Even when there was a publisher who understood the news value of science, there were pitfalls. About a year before the organization of Science Service, when I was on the staff of the National Bureau of Standards, after sundown I wrote science news for the old Washington *Herald*, then owned by Julius Barnes and Herbert Hoover. The fact that ragweed, not goldenrod as most people believed, causes hay fever was reported at a local meeting. My story was slugged for page one, much to my delight. Imagine my chagrin the next morning to find that a friendly copyreader had "corrected" the story to read that goldenrod causes hayfever! Frequently even today copyreaders, and others, have to read something new three times or more before they believe it.

"Not interesting *if* true, but interesting *and* true" was one slogan used in the early days of Science Service. Newspaper science is less suspect now. It was a long and arduous struggle to convince scientists, on the one hand, and editors, on the other, that science could be written popularly so as to be accurate in fact and implication and yet be good reading in newspaper columns.

Then, as now, the annual meetings of the AAAS were major occasions for Science Service coverage. The Toronto meeting at Christmastime in 1921 was the first covered by special press telegrams directly to newspapers. For this meeting, too, Science Service devised the familiar "blue sheet" method of asking those on the program to send in their AAAS papers for press use.

Radio was in its infancy then, too, and Science Service got its baptism in this new medium by doing talks over local stations before there were radio networks. One of the early ventures of Science Service was the issuance of directions as to how to build one's own crystal receiver. Most newspapers had their own radio editors at the height of the set construction era, and these specialists were concerned with the building of sets rather than the programs that were heard. A few of them switched from radio to science writing when the radio craze became less of a boom, and thus these specialists are numbered among the early science writers of the present era.

It took about a decade for the specialty of science writing to become recognized by other press associations and the larger newspapers. At about that

time the practice and example of science usage caused the assignment of specialists to the science news and feature field in a number of instances.

The science-writing practitioners banded together later as the National Association of Science Writers, a little "guild" that includes most of the active writers. Today the specialists who write popular science for newspapers and magazines as a full-time occupation number somewhere between 50 and 100.

Without minimizing the continuing operational activities of Science Service, its major contribution might be considered to be that it has made science acceptable to the American press, and that it has made science reporting acceptable and respectable in both newspaper and science circles.

E. W. Scripps, in his first outline of Science Service's purposes, wrote:

> It is only through the press—mainly the daily press—of the country that the vast majority of the people of this country receive any information or education at all. It is, therefore, only through the press that the public can be quickly and well instructed on matters of its greatest interest.

The daily newspaper continues to be a main channel to the public's thought stream. Science is flowing in it with fairly satisfactory volume. Conventional scientific sources, such as meetings, journals, and laboratories, are being covered with regularity. But there is still need for the science reporter and the news editor to view great news events from their science angles, often ignored now because rush of spot news or the urgency of action tends to monopolize the news scene.

Science in its great accomplishments is international news of the first water. But there is plenty of science in local news, valuable to the community and the newspaper itself. The time will come when each newspaper will have a science writer just as it now has a sports editor, a dramatic critic, a political writer, and other specialists. The sphere of this local science editor is the science news of his own home town—what the engineers are doing, what discoveries are made at the college, the activities of the nature hikers, the earnest experiments of the science clubs in the high schools, how a group of amateurs is making a telescope, what the local medical society is doing, the work of the radio club, etc.

As in every task that must be well done in this world, the quality of science reporting is dependent upon the abilities of the person doing it. Preferably, the science writer or editor should be professionally qualified in both science and newspaper work. He should be the type of person who can hold his own in research laboratory or news room.

Although historically young, radio is one of the most lusty of the mass media for taking information to the people. Television is in its early stages, and to join the standard radio services has come FM, with a new spectrum of opportunity. There is much less science on the radio, percentagewise, than in newspapers and magazines. The art of making science understood by voice and sound may be more difficult; the attention of the audience, more evanescent. Nevertheless, science does get its chances at the microphone, in connection with meetings, public events, dedications, and in some dramatic programs. There are some programs of long standing—for instance, Science Service's Adventures in Science each week over the Columbia Broadcasting System network, which in 18 years has presented some 900 scientists as guests.

Early in the work of Science Service individuals desired to obtain direct access to its product. Thus, the *Science News Letter* (weekly) was born as a magazine which now has a circulation of over 50,000. As the weekly summary of current science, it is useful to scientists as well as intelligent laymen, teachers, and others.

Chemistry (monthly) is another Science Service publication available by direct subscription and read by teachers, students, chemists, and others.

Another service to individuals was begun as the result of sending samples of new materials to newspaper editors as a demonstration and reinforcement of articles being sent them. A bit of a new plastic or a piece of other new material created so much interest on the part of the busy editors that it was decided to issue collections of new materials and specimens to individuals, under the title THINGS of science. Each month there are sent to subscribing members 10,000 little blue boxes, each containing a number of specimens, a booklet of explanations, museum legend cards, and directions for a half-dozen to a score of experiments. These experimental kits in a box are widely received in schools, homes, and offices. More elaborate experimental kits have been prepared in a number of instances. With one such outfit, plants may be grown without soil and experiments performed in hydroponics, with plant hormones, etc. With another "Science FUNdamentals" kit, as it is called, the basic experiments in electricity and magnetism may be performed, while still another kit is devoted to phosphorescence and fluorescence.

To about a third of a million young scientists organized in some 15,000 science clubs in the Nation's secondary schools, Science Service, through its Science Clubs of America, furnishes materials and incentive through the sponsors of these clubs. Affiliation of each club with Science Clubs of America is provided without fee, and the basic materials are furnished

upon request. In most of the states there are cooperating junior academies, museums, etc. that give special attention to the science clubs in their states, sponsoring science fairs and congresses.

The Science Talent Search for the Westinghouse Science Scholarships is an educational effort to pick from the senior classes of the Nation's secondary schools the creative scientists of the future. Now in its eighth year, the Science Talent Search has already demonstrated that it is possible to select those who give great promise of being scientists of the next generation. Each year 300 are selected for honors, and,

Watson Davis, present director of Science Service

through cooperation with committees in more than a dozen states, others of ability are selected on a regional basis. This is one of the activities of Science Clubs of America.

The support of the youth interest in science and the efforts of schools and other organizations in science education has become an important part of the national program of science diffusion. In many instances, newspapers cooperate in such activities in their region. No field is richer for future support than that of science for the youth of our land.

One important by-product of popularization is aid to research. Often first news of research results comes to other specialists through a popular channel, particularly if the research happens to be in a different pigeonhole of science. Science Service has lent its aid to research in a number of fields, such as the collection and distribution of cosmic data, the investigation of archeological discoveries, and the location of earthquake epicenters. It has also pioneered in the development of microphotographic duplication and its application to scholarly research materials. Microfilms make available the contents of libraries and allow the publication of research results that otherwise would not be made available.

Because translations of American books are needed in Latin America, Science Service has cooperated with the Department of State since 1943 in administering its book translation program, in part devoted to medical and other scientific books.

In other lands there is a rising appreciation of science information for the layman. UNESCO, through its Natural Sciences Section, is giving special attention this year to the popularization of science, and American experience is being placed at the disposal of that international organization.

Scientific information gathered by American news organizations flows regularly to all parts of the world as part of the regular international services. In some foreign centers, such as Buenos Aires, Mexico City, and Oslo, daily newspapers publish Science Service reports with as much effectiveness as newspapers in the United States.

An increasing amount of research and development is being done in industrial laboratories. Commercial organizations and trade associations are thus an increasing source of scientific information, often of basic importance. In the last quarter-century, the information issued as publicity on behalf of industrial laboratories has grown in volume. Public relations efforts on behalf of scientific institutions, as well, provide welcome raw material for the science writer and popularizer.

One of the most essential factors in our present progress is the differentiation between popularization and propaganda. Proselyting should have no more place in dissemination than in research itself. And research perishes when it is linked to a particular idea of government, religion, economics, race, or philosophy.

In his original expression upon Science Service, E. W. Scripps presented this ideal clearly and forcefully:

> The first aim of this institution should be just the reverse of what is called propaganda. Its objects should never be to furnish argument or facts for the purpose of producing partisans for any particular cause. Its sole object should be to present facts in readable and interesting form—facts on which the reader could and probably would base his opinion on a subject of politics, sociology or concerning his duty with regard to himself and his fellows.

Such words are worth remembering in these troubled times when so many peoples are told what they must and must not believe. Not even science must be allowed to become a dictator. Science must set the example for straight thinking, confident that the processes of democracy guided by scientific method and reason will give the effective result.

W. Hawkins (1939), Ludvig Hektoen (1935–38), Harrison E. Howe* (1928–42), W. H. Howell* (1931–42), Vernon Kellogg* (1921–35), F. R. Kent (1924–27), A. H. Kirchhofer (1940–), Karl Lark-Horovitz (1948–), Warren H. Lewis (1942–), Burton E. Livingston* (1930–37), D. T. MacDougal (1921–30), Kirtley F. Mather (1948–), John C.

Entrance to Science Service

A succession of great personalities in science and journalism have aided the cause of science popularization through service upon the board of trustees of Science Service. Four of them have served as president in the 27 years so far: William E. Ritter, J. McKeen Cattell, Edwin G. Conklin, Harlow Shapley. Those who have been Science Service trustees are: C. G. Abbot (1924–46), Carl W. Ackerman (1937–38), Karl Bickel (1939–41), Otis W. Caldwell* (1944–47), W. W. Campbell* (1924–26), J. McKeen Cattell* (1921–44), E. G. Conklin (1937–), Max B. Cook (1944–48), John H. Finley* (1925–40), Frank R. Ford (1941–), E. F. Gay (1921–25), George E. Hale* (1921–24), Ross G. Harrison (1938–), W. Merriam* (1921–31), R. A. Millikan (1921–), George T. Moore* (1921–24), J. Edwin Murphy (1938–39), A. A. Noyes* (1921–27), Raymond Pearl* (1929–35), Marlen E. Pew* (1927–36), M. I. Pupin* (1926–29), O. W. Riegel (1938–), William E. Ritter* (1921–28), Chester H. Rowell* (1921–24), Charles Edward Scripps (1948–), E. W. Scripps* (1921–26), Robert P. Scripps* (1921–38), Harlow Shapley (1935–), Thomas L. Sidlo (1926–36), H. L. Smithton (1928–), Mark Sullivan (1925–38), Neil H. Swanson (1939–), Hugh S. Taylor (1943–), Warren S. Thompson (1936–44), Willard L. Valentine* (1946–47), Victor C. Vaughan* (1925–28), Henry B. Ward* (1935–46), Alexander Wetmore

(1946–), David White* (1927–35), William Allen White* (1921–25), and R. M. Yerkes (1921–25).
* Deceased.

Tomorrow's opportunities in advancing science understanding are constantly increasing, for the horizon moves ever onward, no matter how rapidly we advance. As a dedication of the present and the future, there can be repeated a statement, portions of which have appeared in the fundamental literature of Science Service kept in print since the foundation of the institution in 1921:

In a democracy like ours it is particularly important that people as a whole should so far as possible understand the aims and achievements of modern science, not only because of the value of such knowledge to themselves but because research directly or indirectly depends upon popular appreciation of its methods. The specialist is likewise a layman in every science except his own, and he, too, needs to have new things explained to him in nontechnical language. Scientific progress is so rapid and revolutionary these days that no one can keep up with it without some means of maintaining close contact with its new ideas and discoveries.

Recognizing that science, industry, the public, and the press would benefit alike from increased understanding between the scientist and the layman, the AAAS joined with the Westinghouse Educational Foundation in 1945 to establish the George Westinghouse Science Writing Awards. The purpose of the program is threefold: to encourage more and better science writing in the public press; to attract the attention of able young writers to popular interpretation of science as an important and worthy career; and to help those who train and those who employ science writers. Cash awards of $1,000 are made each year to the newspaper writer and the magazine writer judged best in their respective competitions.

Since the close of the contest year on August 9, a panel of judges representing the press, science, and education has been engaged in reading and evaluating the 180 entries received this year.

The winners of the 1948 awards will be honored at a luncheon scheduled for September 16 during the Centennial Celebration of the AAAS. Following an address by Dr. Edmund W. Sinnott, president of the AAAS, presentation of awards will be made by Dr. Howard A. Meyerhoff, chairman of the Managing Committee.

Science and Life

Ritchie Calder

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE has been called "The Parliament of Science," but it has also been called "The Circus of Science," It is proud of both descriptions because, while it provides the assembly in which scientists discuss with frankness and fervor affairs which concern them and on which they give welcomed advice to the Government, it is also the "ring" in which scientists, whatever their eminence, "perform" for the edification and enlightenment of the man in the street.

When the British Association was first founded in 1831, in England's Cathedral City of York, the Royal Society, the oldest Academy of Science in the world, had already existed for 170 years. It, too, had been founded to encourage the proper understanding of science and its practical applications, but in process of time it had become a "learned society," a foregathering of scientists, who were specialists and who formed a cloistered community of intellect. Then in 1799, the Royal Institution was founded "for diffusing knowledge and facilitating the general and speedy introduction of useful mechanical inventions and improvements." It provided popular lectures (still a feature of Britain's intellectual life). Later it became famous rather as a research institution than as a center for the instruction of the ordinary people. Its greatness depends on its association with Sir Humphrey Davy, Michael Faraday, and later, Sir William Bragg.

But the need came for the scientists to get out of their laboratories and their seminars and to get down into the market place. So the British Association began its annual tour of the populous centers, sometimes going abroad to the cities of the British Commonwealth.

If you were an amateur naturalist, geologist, mathematician, anthropologist, or chemist, or interested in any special aspect of science, the British Association provided special "seances" at which you could not only hear the professional experts expound the latest advances but you could, without humility, take part.

In addition, there were introduced "popular lectures for the benefit of the working classes," and these have been one of the most successful contributions of the British Association, the membership of which is open to the mechanic in dungarees as well as the president of the Royal Society.

Every few decades there has been a soul-searching in the British Association to root out tendencies for it to become yet another learned society confined to professional scientists. The last big struggle was in the 1930s, when the economic crisis and the emergence of Fascism with its denial of the freedom of science led to the setting up by the British Association of a "Division of Social and International Relations."

While the Association itself holds one big congress a year, this Division can meet anywhere at any time and assemble eminent scientists to discuss with the public the critical issues of our times. It can organize a great international gathering like the "Science and World Order" conference held in London in 1941, at the various sessions of which the chairmen were President Benes of Czechoslovakia, the Soviet Ambassador, the American Ambassador, the Chinese Ambassador, and the late Mr. H. G. Wells. Or it may go to an industrial center like Manchester, Britain's cotton city, and confront industrialists and the trade unions with the latest developments, or imminent changes, in the science of textiles.

In all this, the British Association is an entirely free agent. It is not an instrument of Government,

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The 110th meeting of the British Association for the Advancement of Science will be held at Brighton, on the south coast of England, September 8–15.

This year the Association has chosen as its president Sir Henry Tizard, an expert on aeronautical research and chief scientific adviser to the United Kingdom Government, who will deliver his presidential address on "The Passing World" at the inaugural meeting at the Dome, Brighton, on September 8.

The meetings, which will be attended by hundreds of laymen and amateurs as well as by famous scientists from all over the world, will deal with a very wide range of subjects; the program includes addresses, lectures, and discussions on topics such as: Achievements of X-Ray Analysis; Newer Metals and Alloys in Industry; Geology Today and Tomorrow; Biology in Schools; Colonial Development; Movements of Population in the Commonwealth; The Metric System; Building Materials; Human Blood Groups; Color Vision; Changing Aspects of Nutrition; Selection of University Students; Problems of Old Age; Aspects of World Education; Administrator and Teacher; Maintenance of World Food Supply; and Forestry and the Community.

In this article the science editor of the *News Chronicle* (London), himself an executive member of the Association's Division of Social and International Relations, writes of the history and purpose of this world-famous organization.

although every Government in the last century has accepted its intervention. It was the British Association, for instance, which led to the setting up of the largest research institution in Britain—the National Physical Laboratory.

This influence is derived from the fact that the British Association has popular support; through it the scientists have the ear of the public, and when it speaks, statesmen and politicians treat it with due respect.

Sir Henry Tizard

Today, as a result of the Dundee Meeting, fresh issues of deep concern to the British Association have been raised. How far can scientists afford to become involved in statecraft? How can science retain its freedom when it is increasingly dependent on Government finance, and what is the duty of a scientist when his country is in crisis?

Among British scientists there are some who argue that science is the pursuit of knowledge, unconcerned with the ends to which such knowledge may be put; they deny that scientists have any responsibility for the discoveries they make or any duties as functional citizens. But, since the British Association is itself the avowal of the scientists' concern about the abuses of science and of their sense of responsibility to their fellow men, this school of thought is little in evidence in its deliberations.

Moreover, academic science in Britain has never been threatened by Government interference or "bureaucratic direction." British universities are vigorously independent institutions, despite the fact that three-quarters of the finances are derived from the Government. That money is given as grants to be administered entirely at the discretion of the University Senates. In addition, the Government will give direct grants for equipment to university scientists.

The United Kingdom Government is now spending upwards of £75,000,000 ($300,000,000) a year on applied research, through its own research institutions and through "research associations," which are scientific cooperatives formed by industry and the Government. Even in these fields the British Association has staunchly opposed secrecy, either official or trade, and, in everything except military research, the Government has agreed to free publication by the scientists of their results.

Scientists, through a committee answerable only to the Cabinet, administer and direct the finances and projects. The threat of Government domination is not, therefore, a serious cause of concern to the British Association. It is the role of the scientists themselves which is causing anxiety. As Sir Henry Dale, last year's president, said at Dundee, in reviewing the incredible achievements of wartime research, much of the success was due to intensive and expensive teamwork and concentration on the attainment of immediate objects. Moreover, brilliant scientific minds were diverted from their own specialties to such fields as military strategy and tactics. Now, added Sir Henry, they are needed in their laboratories and in the classrooms, to promote new discoveries and to teach the new generation of science students whose numbers will be doubled in the next 10 years.

But the very men about whom he was anxious, men whose contributions to victory are now legendary are those who argued at the British Association that the methods which they applied so effectively to the complex problems of war are directly applicable to the problems of reconstruction. They want the scientists to be mobilized again to deal with Britain's crisis.

Whether the scientists should return to the laboratories and the long-term researches which can help to maintain Britain's pre-eminence in original discovery or whether they should commit themselves to the work which can be of immediate and short-term assistance to the country is a dilemma of the scientific conscience.

Eighth International Congress of Genetics

M. Demerec
Carnegie Institution of Washington, Cold Spring Harbor, New York

A VERY SUCCESSFUL INTERNATIONAL CONGRESS OF GENETICS, the eighth of the series, was held in Stockholm from July 7 to 14. The attendance far exceeded the expectation of the organizers, and, what is more important, the representation was world-wide. According to a report made at the final session by the Secretary-General, the total attendance was about 600, from 38 different nations. There were two main reasons for this wide representation: first, the efforts of the local committee, which, with the aid of very modest support from UNESCO, succeeded in helping a considerable number of geneticists to attend the Congress; second, the increased interest in genetical research, particularly in South American countries, that resulted in increased attendance from those countries. The organizers of the Congress wisely decided not to restrict the attendance of German and Japanese geneticists and made a successful effort to bring several leading workers from Germany and one from Japan. Germany had a total of 7 representatives, from all four zones of occupation. The largest contingent of registrants was from Sweden (150 members), with Great Britain in second place (106 members), and the United States third (94 members). A serious deficiency in the attendance was caused by the absence of Russian geneticists, who, according to the official statement received by the organizing committee, were too preoccupied with work to attend the Congress. This was particularly regrettable, because many geneticists were very anxious to meet their Russian colleagues and re-establish contacts that have been weak for more than a decade. We had hoped that an international congress might provide the opportunity of giving well-deserved recognition to the splendid accomplishments of the ever-diminishing group of geneticists in Russia. That the troubles of Russian geneticists are not yet over is indicated by the fact that they were not allowed to participate in the Genetics Congress, even though Russian delegations attended the International Congress on Radio Communications held the second week of July in Stockholm and the Thirteenth International Congress of Zoology in Paris the same month.

The opening session of the Congress was addressed by its president, H. J. Muller, who gave a brilliant survey of the important problems faced by genetics and pointed out the connection between genetics and certain sociological and political problems. This was followed by a session of three introductory addresses by C. D. Darlington ("The Working Units of Heredity"), T. Kemp ("The Rise of Human Genetics"), and J. B. S. Haldane ("Mutation in Man"). The remainder of the program was devoted to sectional meetings for the presentation of papers, three sections being held simultaneously during each morning and afternoon session. A few of these were "long" papers, with a maximum presentation time of 35 minutes, but the majority lasted not more than 15 minutes each.

Some idea of the problems discussed at the Congress may be obtained from the titles of the various sessions: Human Genetics (6 sessions); Artificially Induced Mutations (5 sessions); Population Genetics (3 sessions); Quantitative Inheritance (2 sessions); Plant Cytogenetics (2 sessions); Animal Cytogenetics; Polyploidy; Numerical Chromosome Variations; C-Mitoses and Nuclear Physiology; Chromosome Structure and Movements; Noneuchromatic Inheritance; Supernumerary Chromosomes and Meiosis Problems; Gene Analysis in Microorganisms; Genetical Mathematics; Genetics and the Species Problem; Physiogenetics; Serological Genetics; Linkage and Gene Analysis in Plants; Environmental Control and Gene Expression in *Drosophila*; Animal Psychogenetics; Mouse Genetics; Mouse Physiogenetics; Color Inheritance in Mammals and Birds; Principles of Applications Within the Field of Agriculture; and Cattle Genetics.

These topics reveal the problems that were emphasized at the Congress and, to some extent, give an indication of present-day trends in genetical research. It is not surprising that research on human genetics received important recognition (2 introductory addresses and 6 sessions were devoted to this field), since the Scandinavian countries are taking a leading part in this line of work. In Sweden and Denmark a great deal of emphasis is placed also on research dealing with cytological and cytogenetical problems, and these topics, under various titles, were discussed at 9 sessions. Two topics that appeared on the program, one dealing with chemically induced mutations and the other with heredity in microorganisms, covered new fields of research, opened up since the previous Congress. The present intense activity of research on chemically induced mutations was reflected in the fact

that two sessions were devoted to this work. Research with microorganisms, on the other hand, did not have a fair share of representation, partly because this work had been discussed at the Microbiological Congress held in Stockholm last year and partly because of a meager representation of American geneticists working in this field.

In addition to the presentation of papers, a program of demonstrations was held in 9 half-day sessions. Twenty-three demonstrations were listed on this program, four of them by American geneticists. The most elaborate of these was the exhibit of C. E. Keeler, which gave a graphic representation of a complex relation in rats between characters affecting coat colors and certain physical and behavior traits.

An important attraction of the Congress was furnished by the preliminary excursions and demonstrations organized by the local committee. In Sweden, more than in any other country, discoveries made in genetical research have been applied to plant and animal breeding, ever since the early days of the science, and very striking results have been obtained, particularly in the effort to improve cereals and other field crops. Centers for plant-breeding work are located in southern Sweden, where a four-day excursion, participated in by about 160 persons, included visits to the Institute of Genetics and the Botanical Garden in Lund, the Horticultural Station in Alnarp, the Plant Breeding Institute and the Gardens of the Institute of Genetics in Svalöv, the Institute of Forest Tree Breeding in Källstorp, the Weibullsholm Plant Breeding Institute in Landskrona, and the Sugar Beet Breeding Institute in Hilleshög. A similar four-day excursion to animal-breeding institutes in southern and central Sweden was organized for those interested in that line of work.

The Swedes were perfect hosts to the visiting geneticists. During the pre-Congress excursions we were entertained at luncheons by the institutions we visited and also at a dinner given in Lund by the Swedish seed growers. On the first evening of the Congress the City of Stockholm held a reception in its most unusual and beautiful City Hall. We spent an evening at the ancient Royal Residence at Drottningholm, where we were entertained by a performance at the palace theater, which has remained unchanged since the 18th Century. We were guests at the National Art Museum, where we had an opportunity to see the famous exhibition of paintings and sculptures from Vienna museums. On Sunday we went to Uppsala, where we visited the University, the Royal Agricultural College, the Linnaeus gardens and residence, and Old Uppsala with its grave hills dating from the 5th Century. The University of Uppsala was our host for lunch, and in the evening we were guests of the City of Uppsala at a Congress dinner held in the magnificent hall of the 16th-century castle.

The local committee, with Prof. Gert Bonnier as Secretary-General, did a splendid job of organizing the Congress. All meetings were held in the city recreation center (Medborgarhuset), which contains an excellent auditorium and lecture halls. In the same building, well-planned information, travel, banking, and mail services, writing facilities, and light refreshments were readily available to the members of the Congress. The program ran smoothly, and the schedule was well adhered to, so that it was a simple matter to hear papers given in different sections. Printed copies of the detailed program and of abstracts of papers were available. In addition, the Swedish geneticists had prepared for the Congress two printed pamphlets, one (61 pp.) describing the institutions visited on the pre-Congress tours through southern Sweden and the other (35 pp.) on "Contemporary Genetics in Sweden," with brief outlines of problems being investigated by Swedish geneticists and a list of research workers in the field. For the ladies accompanying members of the Congress, a well organized program was arranged, including visits to historical sites, to pottery and chocolate factories, and to art exhibits.

At the final business session of the Congress, 13 members were elected to the Permanent International Committee, the 14th place being left vacant for a Russian member to be added in the future. Two invitations were received for the holding of the next Congress, one from the United States geneticists and the other from the Italian geneticists. The latter was issued tentatively, pending the result of consultation with the Italian government. The Congress authorized the International Committee to decide the place of the next Congress, expressing a preference for Italy. As authorized by the Congress, the International Committee decided to join the International Union of Biological Societies.

It may be of interest to mention that Prof. E. Tschermak was a member of the Congress and one of the most regular attendants at the scientific sessions and on the excursions. It will be remembered that Tschermak was one of the three rediscoverers of Mendel's papers, and consequently one of the originators of the science of genetics. His active participation at the meetings brought vividly to our attention how young a science genetics is.

Including the families of members, more than 100 persons from the United States were at the Congress. Considering that it was not easy this summer to get reservations for travel abroad and considering, also, the high cost of such travel, the American representation was very good indeed. This may have been

due in part to the efforts made by the Genetics Society of America to stimulate interest in the Congress among its members. In 1946 the president of the Society appointed a travel committee (R. C. Cook, M. Demerec, Th. Dobzhansky, and M. M. Rhoades), which kept members informed about the preparations for the Congress and about travel facilities, and which appointed a travel agency to serve the geneticists. Travel arrangements were greatly facilitated by the Swedish-American Line, which reserved 50 round-trip passages for geneticists. In addition, the Genetics Society was fortunate in obtaining grants from the Carnegie Corporation and from Mr. W. P. Draper to help members with travel expenses. Twenty-two members, mostly from among the younger geneticists, received travel grants from the Society.

NEWS and Notes

William G. Madow, of the North Carolina Institute of Statistics, Chapel Hill, has been named professor of mathematical statistics at the University of Illinois, effective January 1, 1949.

Stanley J. Czyzak, who for the past two years has been a Stephen H. Wilder Research Fellow at the University of Cincinnati, has joined the Experimental Nuclear Physics Division of Argonne National Laboratory, Chicago, as an associate physicist.

Alex B. Novikoff has been appointed associate professor of experimental pathology at the College of Medicine, University of Vermont. In his new position he is in immediate charge of the Cancer Research Program within the Department of Pathology which at present includes studies of the biochemical and cytochemical changes in growth and neoplasia.

John L. Magee, of the Argonne National Laboratory, has been appointed assistant professor in the Chemistry Department, University of Notre Dame, and **Ernest L. Eliel,** who has recently received the Ph.D. degree from the University of Illinois, has been appointed an instructor in the same department.

E. L. LeClerg, who has been a principal budget examiner in the Bureau of the Budget, Executive Office of the President, Washington, D. C., has been appointed a research coordinator in the Agricultural Research Administration, USDA. His coordination work will be in the field of crop production.

William H. Adolph recently became professor of biochemistry at Peiping Union Medical College. Dr. Adolph had formerly served as biochemistry professor and acting president of Yenching University, Peiping, China.

Morton M. Rayman, chief of the Biochemical Section, Fermentation Research Department, Publicker Industries, Inc., has been named chief of the Microbiological Branch of the Food Research Division, Quartermaster Food and Container Institute for the Armed Forces, Chicago. In his new position, Dr. Rayman will direct research on the nature and factors affecting the microbiological and histological changes which occur in the processing and storage of foods for the armed forces.

Prem Narrain Agarwal, Central Government of India Scholar, recently became a special international trainee under the International Fellowship Program of Joseph E. Seagram & Sons, Inc., Louisville, Kentucky. In June Dr. Agarwal received his Ph.D. in biochemistry from the University of Wisconsin, where he has been working since December 1945 on the production of food yeast from molasses.

George B. Cressey, chairman, Department of Geography, Syracuse University, has been participating in meetings of the International Geographical Union in Brussels and the International Geological Congress being held in London. Dr. Cressey will return to America in mid-September.

Victor Guillemin, Jr., until recently chief of the physics unit of the U. S. Air Forces' Aeromedical Laboratory at Wright Field, has become a biophysicist for the University of Illinois' new Aero Medical and Atmospheric Institute.

Visitors to U. S.

Sir Chandrasekhara Venkata Raman, Indian physicist and Nobel Prize winner, recently completed the last lap of his 5-week tour of the United States by visiting the Polytechnic Institute of Brooklyn. Here he conferred with I. Fankuchen, professor and head of the Division of Applied Physics, as well as founder of the Institute's crystallographic laboratories, which Sir Raman inspected.

Through his research on the spectra, Sir Raman became interested in the study of precious stones and has amassed a collection of some 500 rare diamonds. This, in turn, led to a study of spectrum variations in diamonds and the problem of the origin of luminescence. This work has given physicists new ideas on the behavior of atoms in crystals and promises to throw new light on the phenomena of fluorescence of solids.

On his return to India (see *Science*, July 30, p. 101), Sir Raman will direct the research and teaching of the newly-completed Raman Research Institute in Mysore province. Patterned after the Royal Institute of London, the Raman Institute will be dedicated to fundamental scientific work. Sir Raman hopes it will become one of the leading scientific research centers as well as an international cultural center accessible to men in all scientific fields.

Rajindar Pal, entomologist for the Malaria Institute of India, will shortly arrive in this country as a research fellow of the National Institute of Health. Dr. Pal will be conducting studies, over the period of the next

year, on the methods of action of DDT on malaria mosquitoes with the Technical Development Division, Communicable Disease Center, USPHS, Savannah, Georgia. For the past two years, Dr. Pal has been working on the penetration of insecticides through insect cuticle at the London School of Hygiene and Tropical Medicine, as a fellow of the Rockefeller Foundation.

Grants and Awards

The Stuart Ballantine Medal of the Franklin Institute will be awarded at Medal Day ceremonies in Philadelphia on October 20 to Ray Davis Kell, who since 1942 has been director of television research at the RCA Laboratories in Princeton, New Jersey. The medal goes to Mr. Kell "in consideration of his outstanding pioneer work in television, the adaptation of this means of communication to military needs, and for his inventive contributions and leadership in the development of color television."

High school seniors from the 25,000 schools in the United States, Alaska, Hawaii, and Puerto Rico are being invited to take part in the 1949 Pepsi-Cola Scholarship Program under which 119 four-year college scholarships and 600 college entrance prizes, totaling $350,000, will be awarded. This is the fifth consecutive year that the Pepsi-Cola Company has financed such scholarships. Winners, selected on the basis of two examinations, will be announced next March. The four-year scholarships include full college tuition, $25 a month, and traveling expenses for the period. College entrance prizes, awarded to runners-up, are worth $50.

John M. Stalnaker, professor of psychology at Stanford University and director of the Pepsi-Cola Scholarship Board, states that in the past four years the program has grown from one in which only 3,729 schools took part to one embracing almost half the secondary schools in the Nation.

Arthur F. Schalk, of the College of Veterinary Medicine, Ohio State University, has been named the 1948 winner of the $1,000 Borden Award presented to a veterinarian for outstanding work in dairy cattle research. The award was made to Dr. Schalk during the meeting of the American Veterinary Medicine Association in San Francisco for his discovery of a fatal cattle disease, resulting from eating of spoiled sweet clover hay or silage, together with methods of its prevention and cure.

The American Council of Learned Societies has just made a grant to the *Linguistic Atlas* providing for 8 months of field work in upstate New York, an area which was left incomplete by the death of Guy S. Lowman in 1941. The field work will be done be R. I. McDavid, Jr., who recently completed the field work in the South Atlantic States and is now finishing a survey of the folk-speech of Michigan. With the culmination of the upstate New York work, materials will be at hand from the entire Atlantic seaboard area—the scope of the *Atlas* as planned by Hans Kurath, its director.

Paul L. Day, head of the Biochemistry Department in the University of Arkansas School of Medicine, has been selected for the 1948 Midwest Award of the St. Louis Section, American Chemical Society. Dr. Day was recognized for his pioneer research leading to the discovery of vitamin M for the treatment of pernicious anemia. The gold medallion award will be presented to him at a special ceremony to be held during the forthcoming Midwest session of the 114th meeting of the Society.

Colleges and Universities

A new Department of Statistics, the functions of which will include training in statistics at undergraduate and graduate levels, research in statistical theory and techniques, and consultation on statistical aspects of university research, will be instituted at Stanford University this fall. Acting head of the Department will be Albert H. Bowker, who has been assistant professor of mathematical statistics at Stanford since 1946. From 1943 to 1945 Prof. Bowker was assistant director of the Statistical Research Group of the Applied Mathematics Panel at Columbia University. Meyer A. Girshick, author of a number of articles on statistical theory and its applications, who has been serving as research statistician for a government research project being conducted at the Douglas Aircraft Company in Santa Monica, California, has been appointed professor in the Department. Other Stanford faculty members whose work already includes special applications of statistics will cooperate in instruction and research. They are: Eugene L. Grant (economics of engineering), Quinn McNemar (psychology and education), George Polya (mathematics), William H. Rich (biology), Paul B. Simpson (economics), Holbrook Working (Food Research Institute), William A. Spurr (Graduate School of Business), and Frank W. Weymouth (physiology).

The University of Arkansas School of Medicine has recently announced several additions to its staff. Among them are Carl E. Duffy, formerly associate professor of bacteriology at Wayne University School of Medicine, who has been appointed professor and head of the Department of Bacteriology and Parasitology succeeding James T. Culbertson, who is now associated with the National Institute of Health; Harry J. Clausen, of the Loyola University School of Dentistry, New Orleans, who has been appointed associate professor of anatomy; James S. Dinning, who will be assistant professor of biochemistry; and James O. Fergeson, Capt., M.C., who was stationed at Shaw Field, Sumter, South Carolina, prior to separation from the military service and who has been appointed instructor in the Department of Anatomy.

James H. Growden, now associate professor of surgery, has been named acting head of the Department of Oncology, which was recently established with the aid of a grant of $21,000 from the National Institute of Health.

The Medical College of Virginia, Richmond, will inaugurate this year a Department of Legal Medicine, the program of which will follow to some extent that of the School of Medicine at Harvard University, which established the first such department. Courses will be offered in the field

of medicine as it relates to the collection of scientific evidence for administering civil and criminal law. The new department, under the direction of H. S. Breyfogle, Chief Medical Examiner of Virginia, will also engage in research and offer postgraduate work to physicians. The first research to be undertaken will be a study of the role of injury in the cause of cancer.

The Department of Biology, University of Notre Dame, recently announced the following staff appointments: Arthur Schipper, formerly of Texas A. & M., as assistant professor in biology (animal physiology); Norbert Scully, of the University of Chicago, as assistant professor in biology (plant physiology); and the Rev. Cletus Bachofer as instructor (phycology). Dr. Scully has been granted a year's leave of absence to participate in radiobiological research at the Argonne National Laboratory.

The Chemistry Department, University of Pittsburgh, recently completed installation of a Collins Helium Cryostat for research in chemical thermodynamics. Determinations of the low-temperature specific heats of a number of substances is currently under way. Later, energy studies of some selected metals and alloys in the ultra-low-temperature range will be undertaken with the cryostat, which permits temperature measurements between 2° K and room temperature.

Industrial Laboratories

"Carbon copies" of powerful lightning bolts are being made by Westinghouse Electric scientists in an effort to improve our defenses against one of the most destructive forces in nature. Lightning strokes trapped at outdoor experiment stations by special instruments which record their current, wave shape, duration, and number of separate components are reproduced in the laboratory and their effects on various materials and pieces of equipment tested. The information obtained is filed for future reference in building improved protective devices.

The most powerful stroke recorded by Westinghouse engineers occurred in the summer of 1947 and was estimated as equal to the current flowing into 300,000 homes. This particular bolt was so powerful that it damaged some of the equipment set up to trap it atop the University of Pittsburgh's 535-foot Cathedral of Learning.

Horizons, Inc., Princeton, New Jersey, has made several additions to its laboratory staff this summer. Samuel Bousky, Ohio engineer and president of the Cleveland Section of the Instrument Society of America, has joined the organization as chief of the Physics Division. Since 1935 he has been concerned with the development of special electrical and electronic instruments for industrial use. New head of the Ceramics Department at the Cleveland laboratory of Horizons is Alexis G. Pincus, who since 1932 has been associated with the Research Department of the American Optical Company. Morris Steinberg, who received his doctorate in metallurgy from the Massachusetts Institute of Technology this past June, has joined the Metallurgy Department staff in Cleveland, while Edward F. Mayer, who was graduated from Yale University this year with a B.S. in physics, will be associated with the Physics Department.

A 70,000,000-volt synchrotron is being constructed by General Electric Company for Queens University, Kingston, Canada, and will be modeled after one developed by the G-E Research Laboratory for its own use in atomic research. The synchrotron, which will be used by members of the Queens University staff and other Canadian scientists in research with high-energy X-rays, will be installed in a special underground chamber and operated from a remote-control station in a nearby building.

Meetings

The fall meeting of the American Society of Mechanical Engineers is to be held this year at Portland, Oregon, September 7–10, with hydroelectric power resources and the wood industries of the Pacific Northwest cofeatured in the technical program. Symposia on hydroelectric power and on light metals will constitute two of the 10 technical sessions planned. All of these will be held at Reed College. Dinner and luncheon addresses will be made by A. J. Groening, head of the Physics Department, Lewis and Clark College, whose subject will be "Atoms for Peace"; Wilson M. Compton, president of the State College of Washington, who will speak on "Engineering in an Era of Big Science and Big Government"; and L. J. Fletcher, of the Caterpillar Tractor Company, Peoria, Illinois, who will discuss "The Engineer's Stake in His Community." During the meetings members of ASME will inspect installations at Bonneville Dam, the world's largest sawmill at Longview, the Reynolds Metal Aluminum Plant at Troutdale, and other plants manufacturing paper and wood fiber products.

A meeting of the Committee on Science and its Social Relations of the International Council of Scientific Unions held at UNESCO House in Paris, June 15–16, was attended by Bart J. Bok, of the Harvard College Observatory; J. M. Burgers (secretary), of Delft, Holland; C. H. Desch, of London; A. Establier, liaison officer ICSU-UNESCO, Paris; and P. B. Rehberg, of Copenhagen—all members of the Committee. Also present were two representatives of the Natural Sciences Section of UNESCO, S. N. Sen and B. Michelsen, designated by P. Auger, who was absent from Europe; M. P. Bonet-Maury, secretary of the World Federation of Scientific Workers; and Wang Ging-Hsi, of the UNESCO secretariat, who represented the Chinese members of the Committee.

After presentation of various reports on aspects of the work of the CSSR and of UNESCO, the method of working of CSSR and subjects to be included in its future program were discussed extensively and several resolutions adopted unanimously.

In the opinion of the Committee the most urgent problems of the social relations of science today are (1) the dangers threatening science from the fact that research has in large measure become dependent on military sources and on industry for financial assistance, and (2) the way in which results of science are introduced into society. In working on these problems the Committee expects to call on both scientific institutions and individual

scientists as well as UNESCO for advice and cooperation. In order to facilitate the work to be undertaken the Committee has pointed out the value of founding a journal devoted to subjects referring to the social relations of science and of providing stipends to research workers to whom special problems could be entrusted. The Committee has requested both the ICSU and UNESCO to grant the necessary financial means for these projects.

The second resolution involved principles of a charter for scientists. It is quoted in full below.

> The prominent position held at present by science in society, and the rapid transformation of the world through the application of science, carry with them for scientific workers special obligations over and above the ordinary duties of citizenship. Besides this the scientific worker has special responsibilities since he or she has the possibility of obtaining information not readily available to the average citizen. It thus becomes the duty of the scientist to: (a) maintain a spirit of frankness, honesty, integrity and cooperation, and to work for international understanding; (b) consciously examine the meaning and purposes of the work that he or she is performing; (c) when in the service of others, inquire into the purpose for which the work is being done and the moral issues that may be involved; (d) promote the development of science in the way most beneficial to mankind and exert his or her influence as far as possible to prevent its misuse; (e) assist in the education of the people and the government in the purposes and the achievements of science.
>
> In order to fulfill these obligations it is necessary to claim certain rights for scientists, the principal ones of which are: (i) freedom of publication and the utmost freedom to discuss one's work with other scientists; (ii) economic security and the right to participate freely in all activities permitted to all citizens; (iii) the possibility of obtaining information about the purposes for which his or her work is being done.

A third resolution had to do with the dangers arising from subvention of research from military sources. The Committee believes that "this influence sooner or later through its secrecy restrictions will lead to the abrogation of the traditional freedom of expression and of publication, and result in directed research not planned primarily for the benefit of science and mankind but rather for its destruction."

It was also agreed that the CSSR should conduct an enquiry among scientists, sociologists, prominent people in educational work, etc. on the meaning of science and scientific cooperation for peace. The results of this enquiry, which is expected to be concluded by the end of September, will be widely disseminated.

As the result of a fifth resolution the Committee will investigate the attention to be given to the human factor in the social relations of science, devoting itself to three principal aspects: (1) the scientist before society, (2) changes introduced in human societies through technological developments, and (3) the antagonisms between biological order and social order.

Prof. J. M. Burgers has been nominated chairman of CSSR, and Prof. M. Florkin, Laboratoires de Biochimie, 17, Place Delcour, Liège, Belgium, secretary.

Members of an expedition to little known Nepal, situated in the shadow of the Himalayas, will sail from Seattle on September 15, according to an announcement from the National Geographic Society, which is sponsoring the expedition in cooperation with Yale University and the Smithsonian Institution. Dillon Ripley, associate curator and lecturer in zoology at Yale, who is heading the party, estimates that about 5 months will be spent in the field, a considerable portion of that time being devoted to natural history study and collection of specimens in Nepal's southern lowlands, which abound in a large assortment of beasts and birds which have never been studied scientifically. Subsidiary work will also be done in adjacent areas of India, including a survey for the Indian government looking toward a national park to preserve the vanishing great Indian rhinoceros.

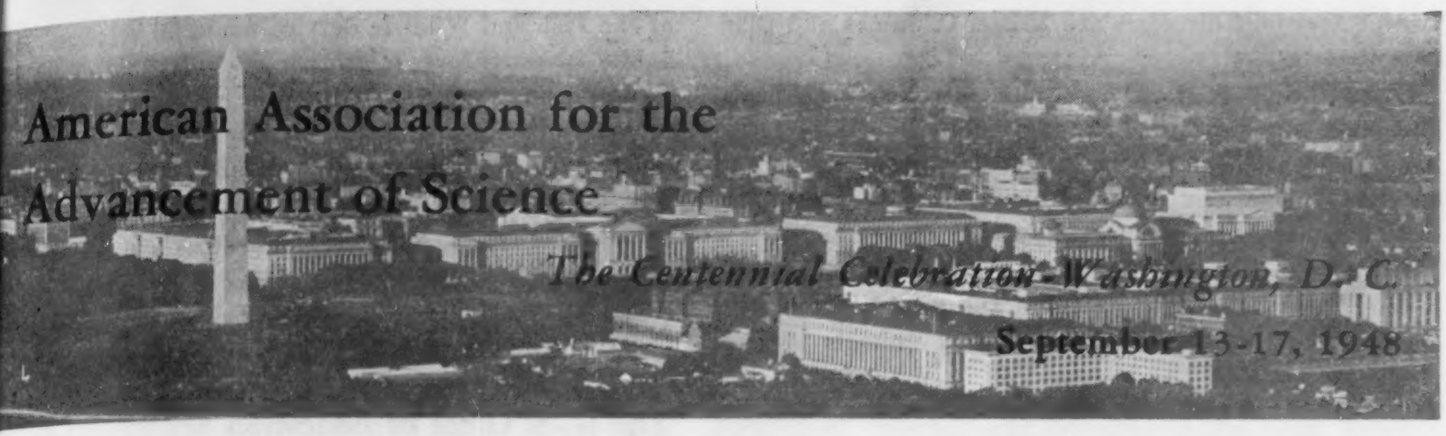
Dr. Ripley will be accompanied by E. C. Migdalski, of Yale's Peabody Museum; Howard C. Weaver and Richard S. Mack, assistant mammalogists, from Fredonia, New York, and Del Monte, California; Volkmar Wentzel, of the National Geographic Society staff; and Indian taxidermists and other personnel to be recruited after arrival in Asia.

The U. S. Department of Agriculture has just announced the appointment of Philip V. Cardon as head of the Agricultural Research Administration. Dr. Cardon comes to the position with 39 years of experience in agricultural research obtained in both university and government work. On May 17 of this year he received the Distinguished Service Award of the Department of Agriculture for "outstanding service and exceptional leadership in the advancement of agricultural science." He fills the position left vacant by the resignation of W. V. Lambert, now dean of the Nebraska College of Agriculture and director of the Experiment Station.

Simultaneously it was announced that Byron T. Shaw, soil physicist, who for the past 18 months has served as assistant administrator of research in the Department, had been appointed deputy administrator. In this position he will be responsible for many of the day-to-day operations of ARA, the largest civilian research organization in the world.

Oak Ridge National Laboratory now has on hand a considerable quantity of Calcium 45, which is formed as a by-product in the production of Carbon 14 by irradiation of $Ca(NO_3)_2$. The specific activity of this Ca 45 is between 0.3 and 0.4 mc/gm of Ca. The material is available for distribution in the form of solid $CaCO_3$ at a cost of $2.20/mc. Those wishing to request the material from the Isotopes Division should specify "Item S-5B" on the Application for Radioisotope Procurement, AEC Form 313.

The American Chemical Society has announced the establishment of a new Local Section at Richland, Washington, manufacturing site of plutonium. The Richland Section to be composed of chemists and chemical engineers of Benton and Franklin counties, has a charter enrollment of 102 members. First chairman of the new section is Robert Lee Moore, of the Technical Department of the G-E Hanford Works, Richland. Other officers, all associated with the Hanford Works, are: Wayne W. Marshall, vice-chairman; Harry A. Kornberg, secretary; and Howard E. Hanthorn, treasurer.



The Weather Bureau

Few scientific organizations in Washington are as much in the public eye as the U. S. Weather Bureau, which has headquarters at 24th and M Streets, N.W. The functions of the Bureau are defined in its Organic Act of 1890 and in subsequent legislation, principally the Civil Aeronautics Act and its amendments. These functions include not only extensive field service and daily public service activities but also fundamental research work in the science of the atmosphere.

In the field service branch of its organization, the Bureau operates nearly 400 stations in the United States and territories, many of them maintaining continuous 24-hour operation every day, including Sundays and holidays. It has more than 9,000 cooperating field stations that supply weather data mainly for climatic and hydrologic reports and studies. The vagaries of the weather with time and place are such that more than 10,000,000 observations of weather per year are necessary to enable the Bureau to record significant features for benefit of agriculture, aviation, business, commerce, engineering, industry, transportation, and the sciences. Some 3,800 different weather forecasts are regularly prepared and issued each day by the Forecast Centrals of the Bureau to serve the needs of aviation and the general public. The timely warnings of hurricanes, floods, cold waves, and other severe conditions are instrumental in saving hundreds of lives and hundreds of millions of dollars worth of livestock and other property every year. The field service of the Bureau constitutes the second largest national weather service in the world.

In its research and scientific services branch, the Weather Bureau engages in basic research aimed at improvement in the accuracy of weather forecasts and in extension of their time range for benefit of agriculture, in particular. With the cooperation of the U. S. Air Forces, which furnishes aircraft and radar equipment, the Bureau for the last two years has carried on an intensive research program in the mechanics of severe thunderstorms and the turbulence phenomena associated therewith. This project has recently been expanded to investigate the possibilities of producing rainfall artificially, testing the much publicized dry-ice method, and also experimenting with other nucleation materials. Another important phase of the research interests pursued by the Bureau is that relating to use of electronics computers to solve some of the fundamental problems in the circulation of the atmosphere and the thermodynamical processes relating to conversion of the sun's radiation into the diverse forms of weather and climate.

F. W. Reichelderfer is chief of Bureau, W. F. McDonald and D. M. Little are assistant chiefs, and R. C. Grubb is budget officer. Division chiefs include: Merrill Bernard (Climatological and Hydrologic Services), L. E. Brotzman (Division of Station Operations), Ross Gunn (Division of Physical Research), C. G. Swain (Division of Personnel), I. R. Tannehill (Division of Synoptic Reports and Forecasts), W. R. Thickstun (Instrument Division), Wm. Weber (Administration), R. H. Weightman (International Meteorological Projects), and H. Wexler (Division of Scientific Services).

The Fish and Wildlife Service

The Fish and Wildlife Service is the agency of the Federal Government concerned with the management of the country's resources in vertebrate wildlife, including fishes and marine mammals. Its complex and diversified work is based on the results of investigations in practically all parts of the United States and in adjacent countries.

The agency was created on June 30, 1940, by the consolidation of the Bureau of Biological Survey and the Bureau of Fisheries. A year earlier both bureaus had been transferred to the Department of the Interior—the Bureau of Fisheries, established in 1871, from the Department of Commerce, and the Bureau of Biological Survey from the Department of Agriculture, where it had been founded in 1885.

The organization consists of the central headquarters in Washington, D. C., 6 regional offices situated within definitely prescribed geographical boundaries, and some 400 field stations consisting of wildlife refuges, fish-cultural stations, biological and technological research stations, fishery market news offices, game management agents, and predator and rodent control district agents. The regional directors and their staffs are located in Portland, Oregon; Albuquerque, New Mexico; Minneapolis, Minnesota; Atlanta, Georgia; Boston, Massachusetts; and Juneau, Alaska.

Albert M. Day has been director of the Service since April 1, 1946, when he succeeded Ira N. Gabrielson, re-

tired. Assistant directors are Milton C. James and Clarence Cottam.

Stated briefly, the Service conducts research on birds, mammals, and fishes to learn the habits, needs, and economic utilization of the various forms; recommends and enforces regulations in the United States for the protection of migratory birds under the provisions of the treaties with Great Britain and Mexico; administers and operates 291 wildlife refuges and 98 fish hatcheries; cooperates in the control of predatory animals and rodents; administers the Federal Aid in Wildlife Restoration Act in the interest of wildlife conservation; and collects, analyzes and publishes data concerning the commercial fisheries, their status, trends, utilization, depletion, rehabilitation, and management.

The Service's principal wildlife research laboratory is located at the Patuxent Research Refuge at Laurel, Maryland, where studies are being conducted on the effects of rodenticides, herbicides, insecticides, and fungicides on wildlife and their foods. In the Denver, Colorado, laboratory the powerful new rodenticide known as "1080" was developed and tested during the war. Research and demonstration projects are conducted in cooperation with land-grant colleges and conservation commissions in 13 states.

During their years of research since 1885, Service scientists have collected more than 140,000 specimens of mammals in North America. Housed in the National Museum in Washington, D. C., this collection—largest of its kind in the world—includes the smallest mammal on the continent, a three-inch shrew, and a Kodiak bear, the largest existing meat eater. The collection is used constantly by the Service and by other Federal and State agencies and the public at large to help answer many controversial questions dealing with grazing, horticulture, predatory-prey relationships, management problems, and diseases.

The primary aims of the Service's fishery research activities are the stabilization of the fishing industry and the management and maintenance of the recreational fisheries. To this end, fishery biological investigations of the causes of fluctuations in abundance of food fishes in the lakes, rivers, and coastal waters of the country are conducted at approximately 20 field stations in the United States, Alaska, and Puerto Rico.

In addition, a wide range of research and service activities is conducted for the producers, dealers, consumers, and allied interests of the commercial fishery industry which produces between 4 and 5 billion pounds of commodities each year. A partial list of recent accomplishments in this field includes the adaptation of Pacific Coast purse seine fishing methods to catching menhaden and other schooling fish in South Atlantic waters, testing and developing wartime substitutes for tin plate and cordage fibers, developing a dry-ice package for fresh fish; devising suitable methods for handling mussels and ocean quahogs; developing special canned fish products for government and domestic purchase; and dehydrating fishery products to save shipping space.

A review of the accomplishments of the staff workers of the Fish and Wildlife Service would fill volumes. F[illegible] habits investigators, migration and distribution exp[illegible] refuge managers, fish culturists, predatory-animal [illegible] rodent control workers, law-enforcement agents, all h[illegible] contributed materially to the detailed knowledge of [illegible] life histories, habits, distribution, and status of [illegible] various forms of fish and wildlife which is so in[illegible] pensable in connection with the administration of [illegible] wildlife resources along the many lines embraced in [illegible] general activities of the Service.

The U. S. Office of Education

In 1867 the Congress stated in part that the Office [illegible] Education exists "for the purpose of collecting [illegible] statistics and facts as shall show the condition and pr[illegible] ress of education in the several States and Territo[illegible] and of diffusing such information . . . as shall aid [illegible] people of the United States in the establishment a[illegible] maintenance of efficient school systems."

It is through its Office of Education, in the Fed[illegible] Security Agency, that the Federal Government provid[illegible] great variety of supporting services to all types of sch[illegible] and colleges, both public and private.

The organization of professional and technical [illegible] in the Office follows the general pattern of educat[illegible] throughout the country. There are 8 operating divisio[illegible] (1) Elementary Education; (2) Secondary Educati[illegible] (3) Vocational Education; (4) Higher Education; [illegible] School Administration, which includes services in [illegible] fields as county, city, and state administration of schoo[illegible] school transportation, state legislation affecting scho[illegible] financing education, school building surveys and pl[illegible] ning, and the business management of schools; [illegible] Auxiliary Services, including the educational uses [illegible] radio, services to libraries, visual education, school-co[illegible] munity recreation, administration of school health se[illegible] ices, and problems of school lunch management; [illegible] International Educational Relations; and (8) Cen[illegible] Services, which includes research and statistics, inform[illegible] tion and publications, and budget, personnel, and fi[illegible] services.

In general, these divisions carry on the following br[illegible] functions:

(1) The collection and interpretation of informat[illegible] with respect to education throughout the United Sta[illegible] and other countries in order to make possible intellig[illegible] comparisons and conclusions regarding the efficiency [illegible] educational programs.

(2) The formulation and recommendation of minim[illegible] educational standards which should prevail in the scho[illegible] and colleges of all the states. A related function is [illegible] preparation of suggestion plans for improving vari[illegible] educational practices.

(3) The provision of services of a national or regio[illegible] character that cannot well be undertaken by sin[illegible] states acting alone, e.g. the collection, interpretati[illegible] and dissemination of national statistics, the conduct [illegible] national and other important surveys, or the convening [illegible] conferences of national and regional significance.

(4) The offering of consultative services to states, school systems and higher educational institutions on problems of reorganization, finance, administration, and curriculum.

(5) The coordination of government activities relating to education through schools and colleges.

In all such functions it is apparent that encouragement and stimulation, rather than control, are envisaged as the objectives of the Office for education in the states.

The long-range Office program of working toward the improvement of American education necessitates special research projects and surveys, carried out by the specialists in the various divisions. Such projects are continuous, varied, and extensive. Typically, their results are reflected in school systems throughout the Nation.

Examples of the down-to-earth, nation-wide results being achieved as the direct result of research done by the Office may be noted briefly:

(1) During the past year the Office of Education has given substantial assistance to the states in strengthening educational programs related to national security. This new emphasis was made possible by the Congress through an increase of approximately 30% in operating funds during the past fiscal year. Important research developments went forward in three fields: education for democratic citizenship, education in science and mathematics, and education for health and physical fitness. Much could be done to improve the teaching of science in the schools of the Nation through consultative methods which involve working with cooperating elementary schools, high schools, and colleges of the states through institutes, workshops, conferences, publication of materials, and demonstration teaching.

(2) With the Citizens' Federal Committee on Education serving the Office of Education as lay advisory group, the Office in turn serves the Committee as research staff. Thus, jointly, they have developed a continuing nation-wide radio and press campaign to inform the American people of the extent of the crisis in their schools. Equally significant, this vast information program recommends means for improving the quality of education.

(3) With its own and other organizations' research showing that the Nation's high schools are not meeting the needs of the great majority of our youth, the Office of Education is giving active leadership in preparing high schools to revamp the traditional curriculum. It has long served college-bound youth, or youth destined for the relatively few skilled trades, but it is not adequate for the multitude of youth who are bound for the vast number of unskilled and semiskilled occupations requiring a minimum of training. Helping the states and local communities to understand this problem, and stimulating them to develop educational services adequate for all American youth—these are the aims of the Commission on Life Adjustment Education for Youth, established by the U. S. Commissioner of Education for that purpose. Regional and national conferences, sponsored by the Office of Education, have been and will continue to be of decisive and immediate importance to all the high schools of the Nation.

The following personnel are responsible for the administration of the 8 operating divisions: Acting Commissioner and director, Division of Auxiliary Services, Rall I. Grigsby; director, Division of School Administration, Edgar Fuller; director, Division of Elementary Education, Bess Goodykoontz; director, Division of Secondary Education, Galen Jones; Assistant Commissioner for Vocational Education, Raymond W. Gregory; director, Division of Higher Education, John Dale Russell; executive assistant to the Commissioner and director, Division of Central Services, Ralph C. M. Flynt; director, Division of International Educational Relations, Kendric N. Marshall.

The Food and Drug Administration

The Food and Drug Administration, Federal Security Agency, enforces 5 statutes designed to insure the safety, purity, and honesty of foods, drugs, devices, and cosmetics. Formally established in 1927, the Administration staff continued the regulatory work that it had performed for the 20 previous years as a part of the Bureau of Chemistry, U. S. Department of Agriculture. The Food and Drug Administration and the responsibility for the enforcement of the Food, Drug, and Cosmetic Act, the Caustic Poison Act, the Filled Milk Act, the Import Milk Act, and the Tea Importation Act were transferred to the Federal Security Agency in 1940.

Of these acts, the Food, Drug, and Cosmetic Act requires the main time and resources of FDA and is the only one under which important scientific research is being done. To carry on its enforcement operations the Administration has 16 field stations located in various parts of the country, equipped with laboratories where most of the examinations of foods, drugs, and cosmetics are made. In Washington, the following technical divisions make scientific investigations and conduct examinations requiring special facilities or personnel trained in specialized fields: Cosmetic, Food, Medical Microbiological, Penicillin Control and Immunology, Pharmacology, and Vitamin.

The research work of the Administration is directed toward extending the amount of useful work that can be accomplished in enforcing the law. It is of four different kinds: (1) development of new, more rapid, more precise methods for the examination of products; (2) scientific investigations to furnish background data for policy determinations in the enforcement program; (3) studies related to the formulation of food standards; and (4) research related to actions in the Federal courts.

These lines of research contribute to scientific data on the composition of products under the jurisdiction of the acts enforced, the potency and therapeutic efficacy of drugs and vitamins, and the potential dangers inherent in various substances and combinations of substances. The development of new and improved methods to detect adulteration is the particular province of law-enforcement scientists, who are among the few that have a direct interest in this field. The knowledge acquired in the past four decades in the enforcement laboratories, supple-

mented by the scientific data developed by other groups, and the use of new, more precise testing instruments have made it possible for the Government and industries to eliminate types of contamination that were formerly beyond control.

One of the most significant recent developments has been the investigational work attending the control of the newer antibiotic drugs. FDA scientists pioneered in the wartime work on penicillin, and later on streptomycin. Amendments to the Food, Drug, and Cosmetic Act require that both of these drugs and their products be certified by the Administration before distribution. This certification involves not only the development of testing methods and safety precautions, but basic research on new forms of these substances and their efficacy in clinical use.

The Washington laboratories are located in the 12th and C, S. W., corner of the South Agriculture Building; the administrative offices are in the Federal Security Building at 4th and Independence Avenue, S. W.

U. S. Geological Survey

Established by Congress in 1879, the Geological Survey was charged with "the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain." This directive was at first interpreted to apply only to the public lands of the West, but the Bureau was soon authorized to proceed with "the preparation of a geologic map of the United States."

As the name implies, a principal objective of the Survey from the first has been the preparation of geological maps and reports on the general and economic geology of the country. However, problems of national scope that arose during development of the West led to the assignment of numerous activities not strictly geological in character. Many of these related activities developed into major governmental responsibilities and were subsequently assigned to special agencies such as the Forest Service, Bureau of Reclamation, Bureau of Mines, and Grazing Service. Others remain as an integral part of the Geological Survey.

Base maps were early recognized as essential to geological investigations, and a comprehensive program of topographic mapping was undertaken. Though designed primarily for geological purposes, topographic maps have proved valuable for innumerable scientific and engineering uses and their preparation is now one of the Survey's four major functions.

When the problem of irrigating the arid lands of the West attracted general interest, the Geological Survey was given a specific appropriation to undertake water studies. This work has continued and greatly expanded, and the Survey now investigates as the third of the four major activities, the quantity, distribution, mineral quality, availability, and utilization of surface and underground water supplies of the United States and its territories and possessions.

The Survey's fourth principal function includes (a) classification of the public lands with respect to their mineral and water resources and (b) supervision of mineral (oil, gas, coal, potash, etc.) development of leased public and Indian lands in order to protect the property and miners against wasteful or dangerous operating practices.

In these varied activities the Geological Survey employs about 2,000 topographic, hydraulic, mining, and petroleum engineers, geologists, paleontologists, mineralogists, chemists, physicists, and geophysicists with headquarters in Washington or in field offices, together with several thousand subprofessional, clerical, and other assistants. In connection with the central offices in Washington it maintains laboratories for chemical analysis of rocks and minerals; photogrammetric equipment for preparing planimetric and topographic maps from aerial photographs; cameras, presses, etc. for engraving and printing topographic and geologic maps; and the world's largest geological library (400,000 publications). The present and sixth director of the Survey, W. E. Wrather, was appointed by President Roosevelt in 1943. Other principal administrative officers, general and branch, are: assistant director, T. B. Nolan; administrative geologist, J. D. Sears; chief, Geologic Branch, W. H. Bradley; chief, Topographic Branch, G. FitzGerald; chief, Water Resources Branch, C. G. Paulsen; chief, Conservation Branch, H. J. Duncan.

The Survey has played a significant part in the development of geological and related sciences in this country and elsewhere. Its publications constitute a body of geologic fact and principle that compares favorably in quantity, range of subject matter, and quality with that of other institutions here or abroad. Outstanding scientific contributions have been made by individual members of the Survey in such fields as geochemistry, glacial history, ground-water occurrence, ore deposits, origin of land-forms, paleontology, petrology, and photogrammetry.

The U. S. Forest Service

The Forest Service, an agency of the U. S. Department of Agriculture, is charged with responsibility for promoting the conservation and wise use of the National forest lands, aggregating about one-third of the total land area of the United States.

Although the Service was established in its present form in 1905, government forest work really began with the appointment of a special agent in the Department of Agriculture in 1876 to study forest conditions in the United States. A Division of Forestry was created in 1881, which developed into a Bureau of Forestry in 1901. Forest reserves in the public domain, which had been under jurisdiction of the Department of the Interior were transferred to the Department of Agriculture in 1905, and the Bureau of Forestry, renamed the Forest Service, was placed in charge of them.

Activities of the Service fall into three main divisions:

National Forests. The Service administers 152 National Forests, comprising approximately 180,000,000

acres located in 40 states, Alaska, and Puerto Rico. The national forest resources are managed for orderly and continuous service to the public and for the maintenance of stable economic conditions in local communities. Technical methods of forestry are applied to the growing and harvesting of timber. Livestock grazing is allowed under permit and is scientifically regulated to obtain range conservation along with use of the annual growth of forage. Provision is made for popular outdoor recreation. In cooperation with the states, management is applied to the development and maintenance of wildlife resources. Many of the national forest lands are highly important watersheds, and the watersheds are managed for regulation of stream flow, reduction of flood danger and soil erosion, and protection of sources of water for power, irrigation, navigation, and municipal and domestic supply.

Cooperation in Forestry. The Service cooperates with the states in the encouragement of sound forest management practices on state and private forest lands. Cooperative programs are carried on in the development and maintenance of organized protection of forest land against fires; in the distribution of planting stock to farmers for windbreaks, shelterbelts, and farm woodlands; and in providing technical advice to farm woodland owners on forest management and on marketing of farm forest products. The Service cooperates with the states to stimulate development, proper administration, and management of state forests, and with communities, counties, and organizations in the development and management of community forests. It also administers the agricultural conservation program as applied to the naval stores industry.

Research. The Service maintains 11 regional forest and range experiment stations, with a number of branch stations and research centers, where investigations are conducted in the entire field of forestry and wild-land management, including the growth, protection, and harvesting of timber, management of range lands, and forest influences. A Tropical Forestry Unit in Puerto Rico conducts research in tropical forestry and serves as a center for exchange of technical information among foresters of the Central and South American countries. The Forest Products Laboratory, at Madison, Wisconsin, conducts studies looking to efficient and economical utilization of wood, reduction of waste, and development of new uses for forest products. A Division of Forest Economics compiles forest statistics, conducts studies in the economics of forestry, and is making a nation-wide survey of forest resources.

In the growth of the forestry movement in America the Forest Service has been a leading agency. Development of the National Forest system was the first great step in conservation. Forest Service research has provided in large measure the technical foundation for forest management in this country. The Service pioneered in organized, systematic forest-fire control. Its Forest Products Laboratory has become the foremost institution of its kind in the world, with a long list of outstanding accomplishments.

Headquarters of the Service are in the South Agriculture Building, Washington, D. C. The Service maintains 10 regional offices—at Missoula, Montana; Denver, Colorado; Albuquerque, New Mexico; Ogden, Utah; San Francisco, California; Portland, Oregon; Philadelphia, Pennsylvania; Atlanta, Georgia; Milwaukee, Wisconsin; and Juneau, Alaska.

Chief of the Service is Lyle F. Watts. Assistant chiefs are R. E. Marsh, E. W. Loveridge, C. M. Granger, E. I. Kotok, R. E. McArdle, and Howard Hopkins.

The U. S. Coast and Geodetic Survey

The U. S. Coast and Geodetic Survey, a Bureau of the Department of Commerce, was created on February 10, 1807, during the administration of President Thomas Jefferson, for the purpose of surveying and charting the coastal waters of the United States. The undertaking had the backing of leading scientists, notably members of the American Philosophical Society, who advised President Jefferson on a fundamental plan of operation. The plan finally adopted was submitted by Ferdinand R. Hassler, one of the originators of the Geodetic Survey of Switzerland, who later became the first superintendent of the Survey.

The Bureau has grown with the Nation's territorial expansion and commercial development. Today, the full scope of its work embraces such activities as: surveying and charting over 1,000,000 square miles of coastal waters in the United States and possessions; the establishment of precise geographical positions and elevations in the interior of the country; observation, analysis, and prediction of tides and currents; a magnetic survey of the United States and the regions under its jurisdiction; preparation of aeronautical charts for civil aviation; and seismological observations and investigations.

Some 900 nautical charts and 800 aeronautical charts are published at the present time to meet the needs of the mariner and aviator. Over 100,000 miles of first- and second-order triangulation arcs and over 300,000 miles of first-order leveling have been established within the United States, for use in Federal, State, and local mapping and engineering projects.

The central office of the Coast and Geodetic Survey is located in Washington, D. C. Field offices are maintained at a number of prominent coastal ports and at several cities in the interior for closer liaison with commerce and industry. The Bureau is subdivided into 8 major Divisions, constituted along functional lines, to direct its field and office activities. The personnel consists of a commissioned corps and a civilian staff, both recruited from Civil Service registers. The administration of the entire Bureau is under the supervision of a director and an assistant director, both holding the rank of Rear Admiral.

The record of the Coast and Geodetic Survey is one of service to commerce, industry, engineering, and science. Its work, although of a practical nature, is carried on with scientific accuracy. During its long history it has made many significant contributions to scientific thought, resulting directly from its own researches and

as by-products of its activities. Its investigations in the field of geodesy have furnished a more accurate figure of the earth and a substantiation of the theory of isostasy; a theory of tides has been formulated and quantitative data collected for the study of coastal stability; the development of acoustic and radio-acoustic methods of hydrographic surveying has furnished basic data for the study of submarine geology.

Additions are constantly being made to its storehouse of scientific knowledge. Some of the researches under way at present are: investigations of gravity anomalies and their relation to the deflection of the vertical; studies of horizontal and vertical earth movements in areas of seismic activity; the development of a general warning system for seismic sea waves; and the improvement of electronic equipment for the extension of accurate hydrographic surveys to the Continental Shelf and beyond.

Rear Adm. Leo Otis Colbert is the present director of the Bureau, and Rear Adm. Jean H. Hawley is assistant director.

The Society of American Foresters

The Society of American Foresters, organized in 1900 in Washington, D. C., is a nonprofit, professional organization of nearly 6,000 technically trained foresters. It is wholly independent of influence by government and industry, and it is spokesman for the profession as a whole rather than for any group or agency.

The objects of the Society are to represent advance, and protect the interests and standards of the profession, to provide a medium for exchange of professional thought, and to promote the science, practice, and standards of forestry in America. The Society is the organization through which trained and practicing foresters express the views of the profession and lead in shaping the policies and techniques of forestry in America.

The governing body is a Council of 11, elected for two-year terms. The present Council is serving for the period 1948–49.

The officers are the president and vice-president, who are members of the Council, and the executive secretary, who is appointed by the Council. These incumbents are: president, Clyde S. Martin, Weyerhaeuser Timber Company, Tacoma, Washington; vice-president, Charles F. Evans, U. S. Forest Service, Atlanta, Georgia; executive secretary, Henry Clepper, Washington, D. C.

The Society's official organ is the *Journal of Forestry*, a monthly professional magazine devoted to all branches of technical forestry.

Eight technical subject divisions, each with its own elected officers, provide effective means for considering various phases of forestry. A meeting of each division is held at least once a year in connection with the annual meeting of the whole Society. These divisions are concerned with forest-wildlife management, forest economics, forest products, forest recreation, forestry education, private forestry, range management, and silviculture.

In addition, there are 21 regional sections, every member of the Society being entitled to membership in the section in which he is domiciled. Most of the sections hold at least two annual meetings, an indoor winter meeting and an outdoor summer field meeting. Frequently the sections undertake special projects leading to the publication of bulletins, articles, and other technical information for their territories.

Working through a special committee, the Society is the sole accrediting agency for professional forestry education in the United States. Among its current technical activities are a revision of the forestry terminology, the compilation of a foresters' field manual, and the standardization of grades for forest planting stock. A recent publication is the book *Problems and progress of forestry in the United States*, written by a joint committee of the Society and the National Research Council.

Naturally, the Society of American Foresters actively cooperates with other professional and scientific organizations. It has a representative in the Division of Biology and Agriculture of the National Research Council, and in the Council of the AAAS, with which it is affiliated through Section O (Agriculture).

Its national headquarters is in the Mills Building, 17th Street at Pennsylvania Avenue, N.W., Washington, D. C.

The National Education Association

Established in 1857, the National Education Association of the United States for 91 years has been the center of the professional life of American teachers. It is dedicated to "the upbuilding of democratic civilization and supported by the loyal cooperation of the teachers of the United States to advance the interests of the teaching profession, promote the welfare of children, and foster the education of all the people."

The Association, an independent, nongovernmental organization, has more than 440,000 individual members with affiliated associations in 52 states and territories and in more than 2,200 local communities of the United States. It is now in the midst of a Victory Action Program for the advancement of education, which began in 1946 and has 1951 as the year for the achievement of its 21 goals. Its policies are determined by its members. It cooperates with all groups in American life who wish to improve education, but it affiliates with none of these groups. It works, however, for better schools and for the improvement of the professional, economic, social and civic status of teachers.

Only members of the teaching profession are eligible for active membership in the NEA. Membership is voluntary. Although classroom teachers constitute the vast majority of the membership, school principals, supervisors, superintendents of schools, college professors, and university presidents are also members.

The NEA owns its own headquarters, a 7-story building at 1201 16th Street, N. W., Washington, D. C. Approximately 350 persons are employed full time at the headquarters, under the direction of Executive Secretary Willard E. Givens, who has held this position since 1935.

Each year at the Representative Assembly, which includes around 2,500 delegates elected by NEA members in local and state affiliated associations, officers of the Association are elected. Glenn E. Snow, president of Dixie Junior College, St. George, Utah, is NEA president for 1947–48.

Through 29 special departments, the NEA has developed a method of meeting the special, as well as the general needs of teachers. The departments include Adult Education, American Association for Health, Physical Education, Recreation, American Association of School Administrators, American Association of Colleges for Teacher Education, American Educational Research Association, American Industrial Arts Association, Art Education, Association for Supervision and Curriculum Development, Audio-Visual Instruction, Classroom Teachers, Elementary School Principals, Higher Education, Home Economics, International Council for Exceptional Children, Kindergarten-Primary Education, Lip Reading, Music Educators National Conference, National Association of Deans of Women, National Association of Journalism Directors of Secondary Schools, National Association of Secondary-School Principals, National Association of School Secretaries, National Council of Administrative Women in Education, National Council for the Social Studies, National Science Teachers Association, Rural Education, Secondary Teachers, Speech Association of America, United Business Education Association, Vocational Education.

Important commissions are the Educational Policies Commission, the Commission for the Defense of Democracy Through Education, and the Commission on Teacher Education and Professional Standards. The Association also maintains joint committees with the American Library Association, the American Medical Association, and other groups.

With its departments, committees, and commissions, the NEA publishes 21 professional magazines, and nearly 200 other publications annually. These include research studies, bibliographies, and a wide variety of educational materials. The general publication is the NEA *Journal*, which is sent each month during the school year to every member.

An active program of public relations is maintained through releases to the newspapers, radio programs, and speakers on educational subjects. One of the most important public relations activities is the observance of American Education Week. During that week each year approximately 10,000,000 American citizens visit their schools.

In 1923 the NEA called the conference which created the World Federation of Education Associations. In 1946 it called a second conference of representatives of 28 national teachers associations. This conference established the World Organization of the Teaching Profession, of which, with many other national teachers' organizations, the NEA is a member.

The NEA also worked actively for the inclusion of references to education in the United Nations Charter, which led to the establishment of UNESCO.

In 1943 the members of the NEA contributed approximately $400,000 to help the schools promote the conditions which would make for peace.

Another project carried on by members of the NEA was the raising in 1948 of the Overseas Teacher Relief Fund of more than $250,000, which was used to send assistance to the most needy teachers in war-devastated countries.

The Smithsonian Institution

The Smithsonian Institution was established in 1846 under the will of James Smithson, who bequeathed his fortune "to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men." This bequest, amounting to $508,318.46, was formally accepted by Congress and the Institution established by an act approved August 10, 1846. The original bequest has been increased from time to time by other gifts and legacies. The Institution has its home in a building of Seneca brownstone in the Norman style of architecture, erected on the Mall in 1847–55.

The statutory members of the Institution are the President of the United States, the Vice-President, the Chief Justice, and the heads of the Executive Departments. The governing body is a Board of Regents, composed of the Vice-President of the United States, the Chief Justice, three members of the Senate, three of the House of Representatives, and six citizens selected by Congress, two of whom must be resident in the District of Columbia. The Board elects one of its members Chancellor, who acts as its presiding officer. The executive officer is the Secretary of the Institution, who is also elected by the Regents. There have been six secretaries: Joseph Henry, 1846–78; Spencer F. Baird, 1878–87; Samuel P. Langley, 1887–1906; Charles D. Walcott, 1907–27; Charles G. Abbot, 1928–44; and Alexander Wetmore, who was elected in 1945.

The objects of the Institution, as defined in the original plan of the first secretary, are: first, to increase knowledge by original investigation and, second, to diffuse knowledge, not only in the United States, but throughout the world, especially by its publications and by promoting an interchange of scientific thought among all nations.

The achievements of the Institution in the advancement of science are notable, and it is the parent of many of the scientific bureaus of the Government, notably the Weather Bureau, Bureau of Fisheries, and National Advisory Committee for Aeronautics, aside from the 10 government bureaus now under its direction. In addition to the researches carried on under its own roof, scientific investigators in the United States, as well as those abroad, have been aided. Books, apparatus, and laboratory accommodations have been supplied to thousands, and a number of money grants have been made. Personal encouragement and advice have been given, and thousands of letters are written each year in response to inquiries for scientific information.

From the early activities of the Smithsonian Institution a number of dependencies or branches have grown

up, which, with the exception of the Freer Gallery of Art, are supported by appropriations from Congress but are administered by the Institution. These are: International Exchange Service, U. S. National Museum, National Collection of Fine Arts, Freer Gallery of Art, Bureau of American Ethnology, National Zoological Park, Astrophysical Observatory, National Gallery of Art, National Air Museum, and Canal Zone Biological Area.

The Smithsonian publications constitute the principal medium for carrying out one of the fundamental functions of the Institution, "the diffusion of knowledge." The Institution proper issues four series: Smithsonian Contributions to Knowledge (discontinued in 1916); Smithsonian Miscellaneous Collections; Smithsonian Special Publications; and the Annual Report of the Institution. To these series should be added the publications issued under its direction by the National Museum and the Bureau of American Ethnology.

The works issued at the expense of the Institution proper are distributed to about 1,100 of the principal libraries of the world. The Annual Reports, the general appendix of which is made up of selected papers, reviewing in nontechnical language progress in scientific work in all its branches, are public documents and more widely distributed than the other series, being printed in editions of 10,000 copies.

The Library of the Institution is devoted to the collection of periodicals and publications of a scientific nature as well as to the publications of the scientific institutions and learned societies of the world. An accumulation of nearly 1,000,000 volumes has thus been acquired, the main part of which forms the Smithsonian Deposit of the Library of Congress. Smaller libraries are maintained at the various branches of the Institution, and sectional libraries of technical works in all branches of science are maintained for the use of the scientific staff.

Special Exhibits at Library of Congress

On September 12 a special exhibit honoring the AAAS on the occasion of its 100th anniversary will open at the Library of Congress. Rare books, manuscripts, maps, and pictorial material highlighting the achievements of American scientists will be featured in the display, which may be seen until October 15.

Among the treasures exhibited in the Rare Books Division will be a 15th-century manuscript of the popular encyclopedia, Bartholomaeus Anglicus' *De proprietatibus rerum*; incunabula editions of Aristotle, Lucretius, Ptolemy, Strabo, and other classic authorities; rare issues of some of the monumental works of European scientists, such as Copernicus, Galileo, William Harvey, and Sir Isaac Newton; and, among American publications, Hodder's *Arithmetic* (1719), the first mathematical book printed on this side of the water, and Benjamin Franklin's *A proposal for promoting of useful knowledge* (1743), which set the movement under way for the foundation of the American Philosophical Society.

Two other sections of the exhibit, which will be on view in the South Curtain of the second floor of the Library, will deal with the role played by Presidents of the United States in promoting science and with noteworthy American scientists and inventors of the past. Pieces on display will include a letter of Thomas Jefferson to the American Philosophical Society (January 28, 1797), acknowledging his election as president of that body and paying tribute to Benjamin Franklin. Also shown will be letters or papers written by Louis Agassiz, Thomas A. Edison, John Fitch, Robert Fulton, Matthew Fontaine Maury, Samuel F. B. Morse, Simon Newcomb, William Thornton, and other eminent American men of science.

In the Basement display area the Library will present photographs and publications of American Nobel Prize winners in the field of science: Percy W. Bridgman, Arthur H. Compton, Irving Langmuir, Albert A. Michelson, Harold C. Urey, and many others. Here the public may also see how scientific apparatus has been applied to the Library's everyday work. The original prospectus and proposed constitution of the AAAS, printed and circulated 100 years ago, will be on view in a special case.

Other special exhibits are: an exhibit of *Geological Maps*, including representative examples covering the development of these special purpose maps during the past century, which may be seen in the Map Division, and the manuscript of "The Theory of Relativity," by Albert Einstein, a copy which he made in November 1943 of his original manuscript which had been destroyed by fire. This is to be shown in a case in the Great Hall on the main floor as the Exhibit-of-the-Week for September 11–17.

Annual International Photography-in-Science Salon

One of the most interesting high lights of the Centenary of the American Association for the Advancement of Science will be the Second Annual International Photography-in-Science Salon, sponsored by *The Scientific Monthly* and the Smithsonian Institution. Basic requirement of this annual competition is that all entrants shall be actively engaged in scientific research (including photographic), teaching, private practice, or consulting. The entries may depict experimental work, fundamental research, or experimental operations in developmental or applied research.

quiries were received this year from such faraway es as Australia and such unlikely ones as warworn nd. Nearly 300 black-and-white and colored ts and transparencies were entered from 20 states, District of Columbia, England, and Poland.

Prizewinners—Black and White

irst Prize—William F. Meggers, chief, Spectros- y Section, National Bureau of Standards, Wash- on, D. C.: "Natural and Artificial Mercury, 1 A."

cond Prize—E. J. Boer *and* Paul Forgrave, telle Memorial Institute, 505 King Avenue, Colum- Ohio: "Simulated Gas Flow in a Steam Loco- ive Model."

hird Prize—Brian O'Brien *and* Gordon G. Milne, itute of Optics, University of Rochester, Roches- New York: "Bullet-induced Fracture Wave in ss" (10,000,000 frames per second).

Honorable Mention—James Hillier, Stuart Mudd, Andrew G. Smith, RCA Laboratories, Princeton, Jersey: "Bacteriophage Lysis"; Walter R. ischer, Harvard University, Cambridge, Massachu- s: "Radioactive Carbon Synthesized by a Rabbit r Slice Into Glycogen" (mag. 600 ×); Charles F. key, USDA: "Leafhopper Stylets in Sugar Beet iole"; J. J. Nassau, Warner and Swasey Observ- y, Case Institute of Technology, Cleveland, Ohio: bjective Prism Spectra (from ultraviolet to in- red region)"; Muriel C. MacDowell, Department Pathology, Long Island College of Medicine, 335 ry Street, Brooklyn, New York: "A Complete phron From a Human Polycystic Kidney."

Prizewinners—Color Division

irst Prize—*Thomas C. Poulter, Stanford Research itute, Stanford, California, *and* Walter K. Lawton, thwest Research Institute, 8400 Culebra Road, Antonio, Texas: "Photographic Study of the plosive Charge Used in the Poulter Method of smic Exploration—3 Charges"; *Second Prize*— S. Harris, Jr., *and* B. J. Howell, Department of ysics, University of Utah, Salt Lake City, Utah: ffraction Pattern I"; *Honorable Mention*—Frank Johnson, Department of Biology, Princeton Uni- ity, Princeton, New Jersey: "Bacterial Biolum- cence."

he winning entries and other accepted prints in 1948 Salon will be on exhibition September 1–21, 0 A. M. to 4:30 P. M., in the foyer of the U. S. ional Museum, 10th & Constitution Avenue, N. W.

*Dr. Poulter won first prize in the 1947 Salon with his r print of "Results of a Field Test to Determine the ing Necessary to Prevent Countermining in Monroe-Ef- t, Antisubmarine Bombs."

An added feature, during the time of the Centennial Meeting only, will be showings of the superb color motion picture, "Naval Photography in Science," lent by the Department of the Navy. This 28-minute sound movie will be run each afternoon except Tuesday, September 14, every half hour from 1:00 to 4:00 in Room 43 of the Museum, just off the foyer.

The 1948 Judging Committee was composed of A. J. Wedderburn, Smithsonian Institution, chairman; Carleton R. Ball, formerly of the U. S. Department of Agriculture, Washington, D. C., for the biological sciences; Edward J. Stieglitz, Washington, D. C., for the medical sciences; Wallace R. Brode, National Bureau of Standards, for the physical sciences; and Sidney S. Jaffe, Washington, D. C., for photography.

Immediately after the exhibition in the National Museum, the Salon will go on tour. The itinerary follows:

October 1–30, Cranbrook Institute, Bloomfield Hills, Michigan.

November 6–30, Buhl Planetarium, Pittsburgh, Pennsylvania.

December 6–31, Franklin Institute, Philadelphia.

January 6–20, *Science Illustrated*, New York City.

February 3–24, General Foods Corporation, Central Laboratories, Hoboken, New Jersey.

March 7–26, Brown University, Providence, Rhode Island.

April 15–May 1, University of Florida, Gainesville.

May 15–30 (tentative), University of California, Berkeley.

July, Pennsylvania State Museum, Harrisburg.

December, Royal Photographic Society, London, England.

Entries in the *Third* Annual International Photography-in-Science Salon will be received by the editor of *The Scientific Monthly*, 1515 Massachusetts Avenue, N. W., Washington 5, D. C., August 24–September 14, 1949. Prizewinning and other entries will be shown at the U. S. National Museum during the month of October 1949 and at the New York meeting of the AAAS in December. Other showings may be arranged.

Symposium on Cooperation and Conflict Among Living Organisms

A concerted, many-sided drive to advance social science beyond the descriptive stage will be initiated by this symposium, to be held September 11–13. As of August 14, sponsoring organizations and their respective members of the Executive Council included: Botanical Society of America, Inc. (John S. Karling), Ecological Society of America (Chas. C. Adams), Institute of Ethnic Affairs (Laura Thompson), In-

stitute of General Semantics (M. Kendig), National Indian Institute (John Collier), Ohio State University Personnel Research Board (Carroll L. Shartle), Association for the Advancement of Psychotherapy (Eilhard von Domarus), Society for Applied Anthropology (Edward F. Haskell, who is also convening secretary), and Sociometric Institute (Helen Jennings).

On Saturday afternoon from 2:00 to 5:00, in the Auditorium of the U. S. National Museum, John S. Karling will preside over the first session, on Conflict and Cooperation Among Plants.[1] A brief outline of the Symposium's objectives and structure by Edward Haskell will be followed by papers on "Conflict and Its Resolution in the Plant Realm," by Paul B. Sears, of Oberlin College; "Some Aspects of Antagonism and Synergism in Primitive Organisms," by Paul R. Burkholder, Yale University; "Chemical Plant Sociology," by James Bonner, of CalTech; and "Armageddon of the Microbes: A Consideration of Relationships in a Microbiological Society," by Robertson Pratt, University of California.

A session on Heterotypic Cooperation and Conflict, with Chas. C. Adams presiding, will be held on Sunday morning from 9:00 to 12:00 in the Auditorium of International Student House, 1825 R Street, N. W. This will consist of the chairman's address on "The Relation of Human Ecology to a Social Philosophy" and a series of three papers dealing with "Relations of Men, Animals, and Plants in an Island Community (Fiji)," by Laura Thompson, of the Institute of Ethnic Affairs; "Spontaneous Changes of Coaction in Aggregations of Animals and of Men," by T. H. Langlois, of Ohio State University; and "Advances and Problems in the Technology of Human Relations Education" (New York University Center for Human Relations Studies).

That same afternoon, also in International Student House, Anatol Rapoport will preside over a session on Scientific Theories of Cooperation and Conflict, which will be participated in by Douglas M. Kelley, of the Bowman Gray School of Medicine, whose subject will be "General Semantics in the Transformation of Conflict Into Cooperation"; Dr. Haskell, collaborating with Burton Wade and Jerome Pergament, in a paper on "The Coaction Compass: Integration of Independent Discoveries of the Same General Conceptual Scheme by Students of Plant, Animal, and Human Coactions"; and Joseph L. Moreno, of the Sociometric Institute, who will discuss "The So ometry of Living Organisms."

The chairman of the session on Mental Cooperati and Conflict, meeting Monday morning from 9:00 12:00 at 2111 Florida Avenue, N. W., has not b announced. Carroll L. Shartle, E. von Domar and Dr. Haskell will speak, respectively, on "Effecti Leadership in Democracy," "Psychotherapy in t Resolution of Social Conflict; Sociotherapy in t Resolution of Mental Conflict," and "Conflict and C operation Between Western and Eastern Ideologie

The Monday afternoon session, from 1:30 to 4: at the same address, will be presided over by Jo Collier and will strike the keynote of this particul symposium—Organizing Scientific Research for Pea The chairman's address on "The State of Soci Science and Practice" will be followed by a report the representatives of the Executive Council (whi meets preceding the above program) on the objectiv and structure of the proposed permanent organizati and organization of interdepartmental Interim Co missions. The permanent organization is visuali as an OSRD-like organization which may hope succeed in advancing social science through the sta of natural classification and evolution theory, i that achieved by the physical sciences, where scienti fields are connected, and science is closely linked philosophy and technology. The possibility of su coordination of effort emerged with the independe discoveries of parts of the same general concept scheme by students of plant, animal, and hum coactions, to be described in the Symposium's Sund afternoon session. Should this scheme prove to be natural classification, it would create conditions f rapid coordination and advance of social science, the Periodic Table did in chemistry.

Some of the Interim Commissions' probable obj tives—annotated bibliography on cooperation a conflict, systematized vocabulary, and clarification underlying philosophical assumptions—are design to permit mobilization of the mass of accumulat social-scientific data and constructs in preparation a further phase in the organization of scientific r search for peace, the World Congress of Social a Allied Sciences planned for 1949. It is anticipat that the philosophical, scientific, and technologi structures of Western and Eastern ideologies abo conflict and cooperation will have been sufficient clarified by then to make possible their gradual d placement by an advanced social science which systematic, useful, and universally accepted, as ph ical science already is today.

[1] Organization and sponsorship by the Botanical Society of America, Inc., is limited to this panel.

Book Reviews

Elsevier's encyclopaedia of organic chemistry. (Vol. 13, *Tricyclic compounds;* Series III, ***Carboisocyclic compounds.***) E. Josephy and F. Radt. (Eds.) New York-Amsterdam: Elsevier, 1946. Pp. xx + 1265. Single volume, $104; serial price, $91; subscription price, $78.

Volume 13 is the second to appear in this projected compilation in the English language and the second in Series III. In due time, the systematic description of all organic compounds appearing in the scientific literature will have been included. Elsevier has not attempted to cover those compounds described in patents; on the other hand, the well-known Beilstein does refer to the patent literature, although the writer is not informed whether the coverage has been world-wide or limited to German patents.

With the availability of only two volumes of the eventual 20 of Elsevier, a detailed comparison with its counterpart, Beilstein, is not warranted at this time. Of greatest immediate value to the reader may be the description of one or two compounds selected at random and appearing in both Beilstein and Elsevier.

In Elsevier (p. 236):

"*9-Chloroanthracene, $C_{14}H_9Cl$,* golden-yellow needles (alc.), m. 103° (1876 Perkin), m. 106°, M_α 68.14, M_D 69.39, N_β 72.81, M_γ 77.53 (1923a Krollpfeiffer); green in fuming H_2SO_4, addn. of water causes a brown ppt.—Fmn. Anthracene with 1 mol. of Cl_2 in CS_2 $\rightarrow$ dichloride $\xrightarrow{\text{fusion}}$ 9-chloroanthracene (1876 P.). From anthracene and *tert*-butyl hypochlorite (1931 Clark)."

At the bottom of the page on which this description appears is a notation: "References, pp. 258, 259." By turning to page 258, one finds the references listed under the date of appearance.

In Beilstein (Vol. V, p. 663):

"*9-Chlor-anthracen, $C_{14}H_9Cl$.* B. Man lässt Chlor auf Anthracen einwirken und schmilzt das hierbei enstehende Anthracendichlorid (Perkin, *Chem. N., 34*, 145; *Bl* [2] 27, 465).—Goldgelbe Nadeln (aus Alkohol). F: 103°. Sehr leicht löslich in Äther, CS_2, Benzol. Verbindung mit Pikrinsäure s. Syst. No. 523."

In Elsevier (p. 805):

"*9,10-Diethylphenanthrene, $C_{18}H_{18}$,* m. 105–6°.—Fmn. From diethylphenanthrone (p. 891) as the dimethyl compd. (1908 Zincke; cf. 1913 Meerwein)."

In Beilstein (Vol. V, Suppl., p. 339):

"*9,10-Diäthyl-phenanthren,* $C_{18}H_{18} = \begin{array}{l} C_6H_4 \cdot C \cdot C_2H_5 \\ \,| \qquad \;\; \| \\ C_6H_4 \cdot C \cdot C_2H_5 \end{array}$. B Aus 9,10-Diacetylphenanthren durch Reduction mit Jodwasserstoffsäure und rotem Phosphor (Willgerodt, Albert, J. pr. [2] 84, 392). Blättchen (aus Alkohol). F: 90–91°.

"Als 9,10-Diäthyl-phenanthren (?) wird ein bei 105–106° schmelzender Kohlenwasserstoff angesprochen, der bei der Reduktion von 10-oxo-9,9-diäthyl-9,10-dihydrophenanthren mit Jodwasserstoffsäure ensteht (Zincke, Tropp, A. *362*, 254: vgl. Meerwein, A. *396*, 249) und einmal bei der Reduktion von 9-Äthyl-9-propionylfluoren mit Natriumamalgam in saurer Lösung erhalten wurde (Meerwein, A. *405*, 174)."

The formula index appearing in each volume of Elsevier is to be preferred to the name index in each volume of Beilstein, although a complete formula index is indeed available covering all volumes of Beilstein.

This and the previous Volume XIV have merit and are reference works with which all organic research men should be familiar.

ROGER ADAMS

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James McKeen Cattell, man of science. Vol. I: ***Psychological research;*** Vol. II: ***Addresses and formal papers.*** A. T. Poffenberger. (Ed.) Lancaster, Pa.: Science Press, 1947. Vol. I: Pp. 586; Vol. II: Pp. 507. $10.00.

Here is a unique history of the rise of experimental psychology for the first 50 years. It is an on-the-spot commentary by our most authoritative commentator giving an up-to-date report of progress from year to year. In his capacity as spokesman or public relations man for psychology, Cattell has blazed many new trails and fought many a battle for psychology among the sciences. These volumes will be news for the student of today and will stand as a historical classic.

Volume I is a condensed report of the author's personal achievements as a pioneer experimenter in this field. Emphasis is laid upon the historical background of each problem and a discussion of the significance of the method involved. Volume II is a parallel collection of the author's public addresses giving a chronological account of the emerging new psychology. Prof. Poffenberger, as editor, has shown great skill in the selection and chronological organization. Every word of the text is in Cattell's own words as originally published in journals but so selected as to make interesting and economical reading of the story of the rise of psychology in America. Two brief biographical sketches of the author are appended, one by Prof. R. S. Woodworth and the other by Dr. Lyman Wells.

Since the whole is a condensation of the author's 167 articles listed in the chronological bibliography and since the original articles were written as models of brevity and clarity, the space allotted for this review does not

permit an adequate summary of the content, a detailed critique of the author's theories, or historical evaluations.

A review of these volumes reveals Cattell distinctly as a historian for psychology, an experimenter, an organizer and director of societies, a prolific editor and publisher, a financier, a champion for democracy, an artistic writer, and an educator. A word of comment on each of these issues based upon the reading of the two volumes is in place.

As a historian he is objective, critical, operational, interpretative, and entertaining. He is objective in that he reveals the growth of psychological concepts by illustrations from his own experiments and in that his public addresses always deal with some concrete or strategic issue of the day as a contemporary report. He is critical because he adheres to the sanctions of the physical sciences and urges and exemplifies their extension into the mental sciences as far as possible. He is operational in that he avoids mere names and classifications for situations and aims to describe them by precise statement of conditions and techniques of the experiment. He is interpretative in that, in opposition to the prevailing early exclusive trends toward pure psychology, he plays up the usefulness of psychology and shows how psychology can be scientific and at the same time useful. Well grounded in the classic traditions and a lover of good literature, he will be long remembered as an artistic writer and speaker. There is a remarkable euphany in his art of deliberate and adequate communication of fact. In all his approaches he writes as a contemporary reporter of event after event in chronological order. He has had the ears of all the sciences and has done more than anyone else to gain a place for the emerging psychology in the brotherhood of the sciences.

As an experimental psychologist he was a pioneer who came in on the ground floor with the first American group to register in the Leipzig laboratory. He thus got his inspiration from Wundt in the psychophysical approach; but he soon asserted his originality and independence by taking up the technological approach of which Wundt did not approve. He was the first to offer a laboratory course in psychology. Under the head of mental measurements he was the first to introduce differential psychology as applied to anthropology, ethnology, genetics, and education. And by his appointment in the University of Pennsylvania he became the first psychologist to bear the title "Professor of Psychology," psychology having up to that time been carried under the name of philosophy or physiology.

He took his cue for a psychological laboratory from the material sciences and aimed to make it a natural science. He thus made early contacts with naturalists, mathematicians, geneticists, physicists, and astronomers. He was early associated with Sir Francis Galton and laid foundations for mental statistics, which became his chief interest in later life. His chief tool was the "probable error," which someone has said became his god. Even in this he adhered firmly to psychophysical principles and proceeded step by step to exemplify mathematical treatment under laboratory control, breaking new ground and setting up new techniques. This is well illustrated by his psychometric laboratory, set up in Columbia University.

Cattell had but little interest in classroom teaching. His chief method of instruction took the form of comradeship in research and conferences in seminars. He always had something new to report and thus gained a world-wide following through his conferences and the press. He lived through the period of schools, but he did not become an adherent of any school as a partisan; he did not found any school of his own; he profited rationally from every new improvement and was sympathetic to newcomers. He was always ready to trace the ancestry of new ideas and to criticize their ideologies.

Cattell, "a person cast in heroic mode" (Woodworth), stands out most conspicuously in his capacity as editor-publisher. There are to his credit as founder, editor, or financier the following publications: *The Psychological Review* (with J. M. Baldwin), *Science*, *The Naturalist*, *The Scientific Monthly*, *School and Society*, and the two scientifically organized directories, *Biographical Directory of American Men of Science*, and *Leaders in Education*. There are four outstanding features in these ventures: first, the journals were so remarkably well edited that each in turn was taken over as the official organ of the national society in each of the respective fields covered; second, through the recognition of research as a mark of eminence he raised the national level of scientific standards in the respective fields; third, while all were hazardous risks, he managed them so well that each became a model in the field of publication; and fourth, he revealed his devotion to science by his generosity in turning over certain of these publications as gifts to the organizations served.

Academic democracy was Cattell's avocation; he pursued it as a hobby and drove this horse hard. He took peculiar delight in lambasting presidents, head professors, and all sorts of authoritative practice in education and society. Here he found the best outlet for wit, humor, and extravagance and fought valiantly. This brought him into conflict with Columbia University. A law suit resulted in vindication of his position and financial victory but also in his being dismissed from the university under wartime pressure in 1917. This early retirement gave him time and freedom as a scholar-at-large. One must note, however, that success in his championship for democracy in his own ventures was in large part due to the free use of his iron hand.

The publication of these volumes by the Science Press under the direction of his son, Jaques Cattell, is a worthy memorial to the founder of the institution. The editing by one of the author's pupils is a highly commendable work. One can only request that an index be provided in future editions.

As a contemporary of Cattell, the present reviewer has witnessed the unfolding of this history from year to year and going through the material in the present form has revived precious memories of the great pioneer in psychology.

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